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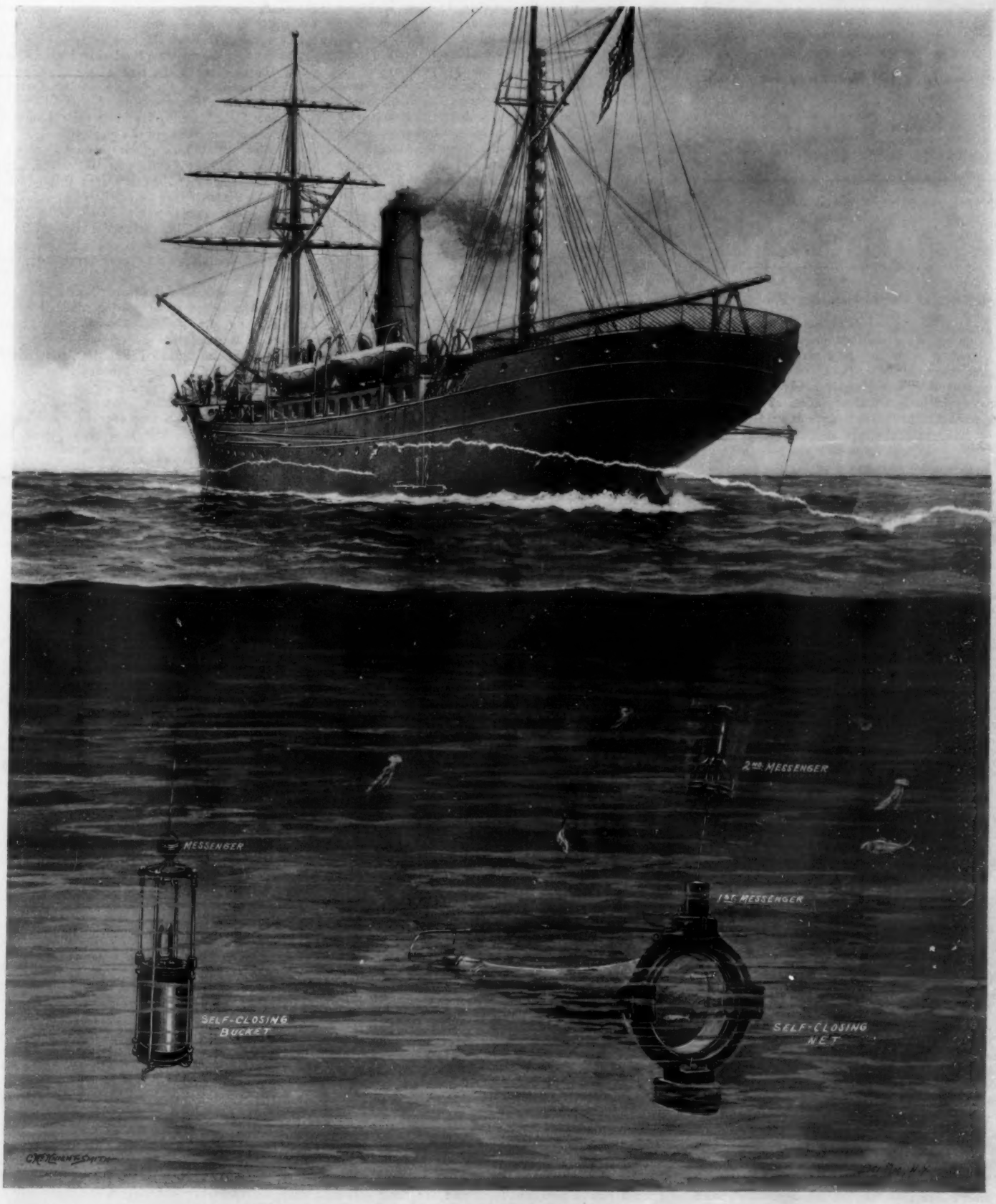


NEW APPARATUS FOR DEEP-SEA EXPLORATION.—[See page 174.]

# SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


*The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.*

## A Solution of the Car-seating Problem

WE invite special attention to the article published on another page of this issue, dealing with the problem of seating on electric and other cars.

It is curious how few electric roads in America have seriously investigated the problem of providing sufficient seats at the rush hours. The feeling is practically universal that no solution is possible, and so no adequate remedy is even attempted. One mistake that is almost always made by companies is that of providing too much standing room. For example, in the present Chicago cars, only about 44 per cent of the floor space is occupied by seated passengers. In the Liverpool double-deck cars, 65 per cent of the floor area is occupied, in spite of the space lost by two stairways.

Few managers seem to realize how many seats can be provided in a car. In Europe, the prohibition or rigid limitation of standing, requires the introduction of every possible seat into a car. If the same thing were done in this country, the result would often be amazing.

If the existing Chicago cars were filled with seats after the plan adopted in Berlin and other foreign cities, instead of 40 seats there would be a maximum possible of 90 seats on a single car. People would naturally have to sit somewhat closer than now, but no closer than on open cars. Aisles would be narrower; but a narrow aisle with no standing room is easier to get through than a wide aisle filled with passengers.

With a new car designed for Chicago, four more seats could be gained, or a total of 90 seats with motor or trailers. Whether so many seats would really be needed may be a question; but it is interesting to see what could be provided under the most favorable conditions. With 90 seats possible on a single car in place of 40, and with trailers of the same size, one-third more seats could be furnished for the same operating expense as with single cars, or 120 seats in place of 80 with Pittsburgh cars and trailers, or 40 with the existing single cars.

To any one who has made a thorough study of how to furnish seats, the problem is far simpler than is generally realized. The solution is largely a matter of car design, and especially of putting in as many seats as a car will hold, and not as few as possible. In the light of Pittsburgh experience, the question for the public and the companies is now whether it is worth while to provide more seats by using trailers. Trailers admittedly bring up new difficulties, and yet they are successfully operated in streets in Pittsburgh, fully as crowded at times as any streets in this country. Their use should be thoroughly investigated by companies and public authorities all over the country. Prejudice or past experience should not be allowed to interfere with an impartial judgment. While trailers cannot compare with double-deck cars for economy and simplicity of operation, or seating capacity, they are less foreign to American practice, and afford a cheap way to increase capacity without increasing cost. The street car companies could make no wiser move than to adopt trailers wherever conditions will possibly permit, and endeavor, without the radical innovation of the double-decked car, to reach the English requirement of a seat for every passenger at every hour of the day.

## An Old Engine Under a New Dress

FROM time to time there appear in cable despatches from abroad announcements of the completion of a new and wonderful type of engine, which is to "revolutionize" our present methods of power production both on sea and shore; and we are told that so perfected is this engine that it is about to be applied wholesale, with the usual accompaniment of sending all existing power plants "to the scrap heap!"

Now those of us who attempt to keep in touch with developments in the world of science and engineering quickly recognize in these reports our old friend the heavy-oil, internal-combustion motor known as the Diesel engine—a type which was invented so many years ago that the basic patents have already expired. Of the merits of the device there have never been any serious doubts; and it was long ago realized that if certain inherent defects could be remedied, this engine would form the ideal drive.

The Diesel engine is a German invention, and to German patience and skill is due the credit of having at last developed this motor to the point at which its range of usefulness promises to be enormously increased. It now looks as though the Germans had achieved success along the three principal lines, on which development for use in the larger powers was indispensible, namely, the improvement of the combustion, the construction of the individual cylinder units on a large scale, and the making of the engine double-acting, that is, making it run successfully with an explosion for each stroke of the piston.

Briefly stated, the advantages of the Diesel engine, as compared with the steam engine, are that it dispenses with the boiler plant and its force of stokers; that it enables a cheap grade of fuel to be used, and that, even with this cheaper fuel, it uses only half a pound per horse-power, per hour, as against the pound and a half of coal, which represents the best average practice in up-to-date steam installations.

Now it is evident at once that these savings of space and weight, and the small consumption of fuel, render this engine an ideal drive for ships, both of the navy and of the merchant marine. For the latter, in addition to the abolition of smoke stacks and tell-tale smoke, its introduction would mean a great increase in the radius of action, together with the liberation of much weight for use in an increased battery or in a more complete armor protection. Nevertheless, we are not as yet on the eve of a total replacement of the steam engine by the heavy oil engine in the navies of the world. Much work remains to be done. Interest is just now centered n the 18,000-horse-power triple-screw engines, which the Germans are putting into one of their cruisers. Should they prove successful, the motor-driven-battleship may be afloat within the next few years.

## The "Olympic"-"Hawke" Collision

IN view of the continued and widespread interest in the "Olympic"-"Hawke" collision, we direct attention to an article by our English correspondent, published in the current issue of the SUPPLEMENT, which describes the investigation which was made by towing models of the two ships in the towing tank, to determine the effects which vessels have upon each other's movements when they are steaming on parallel courses in close proximity to one another.

There is much confusion in the public mind regarding both the remote and the immediate causes of this collision. By remote causes we mean the navigation of the two ships by which they were brought into a certain relative position in respect to one another. By immediate causes we refer to those physical laws by which the two ships were so suddenly and so disastrously brought into collision. The former have to do with questions of navigation and the right of way, and it is upon these that the Admiralty Court recently gave a judgment against the "Olympic"; the latter were causes of a purely physical character, which, when the ships had been brought into a position favorable for their action, were entirely beyond the control of the officers in charge of the vessels.

The physical cause of the collision is what is popularly known as "suction," or the tendency of one ship which is passing another at close quarters to draw the latter violently in toward itself. The phenomenon is perfectly well known among those nautical men who make an intelligent study of their profession. Instances of collision due to "suction" are many and well established; and of late years, both in America and abroad, the matter has been subjected to careful analysis in the towing tank, the latest instance of this being the experiments carried out in the towing tank at Teddington, England, with models of the "Olympic" and the "Hawke," in the course of which it was found that, under similar conditions, the action of the models upon one another was identical with that of the full-sized ships on the day of the collision.

Briefly stated, the effect of "suction" is as follows: If a vessel A is overtaking and passing a vessel B, at the time when the ships are abreast of each other and in close proximity the effect of the disturbance created in the water by the passage of the vessels is to produce a powerful lateral thrust upon the bow of the vessel which has been overtaken, tending to force the bow away from the passing ship. As the faster vessel moves ahead, and at about the time when the bow of the slower ship is abaft the center of the length of the faster vessel, conditions are reversed, and there is set up a powerful force tending to draw the bow of the slower vessel over toward the passing ship. It was the latter condition which brought about the "Olympic"-"Hawke" collision. It was established in the evidence that the helm was thrown over to counteract the swinging in of the bow, but that the lateral force was so powerful as to render the helm entirely useless. The distance between the ships when the "Hawke" began to swing over toward the "Olympic" was shown in the evidence to have been about 300 feet.

The judge of the Admiralty Court, however, ignored the evidence as to suction, neither accepting nor denying its value. Decision was rendered purely on the question as to which ship had the right of way, and he ruled that since the "Olympic" had the "Hawke" on her starboard side, and therefore, according to the rule of the road, should have kept out of the way of the "Hawke," but failed to do so, the collision, from whatever physical causes it may have been due, was chargeable to that ship. The officers of the "Olympic" claimed that the "Olympic" was ahead of the "Hawke," that the "Hawke" was steaming faster than the "Olympic," and that she was, therefore, according to another rule of the road, an "overtaking" ship, and as such, should have kept out of the way of the "Olympic," and that, having failed to do so, she was responsible for the disaster.

Seeing that the White Star Company has appealed, and the case will be brought up for further thrashing out, it is not our place to offer any opinion on the merits of the case. We will content ourselves with a brief statement of the events which brought the two vessels into such close proximity.

Between the Isle of Wight and the south of England is the well-known waterway of the Solent. At about the center of its length it is entered from the north by another channel known as Southampton Water. On the day of the collision the "Hawke" was running her annual steam trials under reduced power at a speed of 15 knots, and was steaming through the Solent in an easterly direction. As she neared the entrance to Southampton Water the "Olympic" was steaming south through that channel, and was about to turn east into the Solent and pass around the easterly end of the Isle of Wight on her way to Cherbourg. She turned to the left (to port) and swung into the Solent with the "Hawke" on her starboard side, her own speed being from 17 to 18 knots. So far, so good.

Now there is a rule of the road, according to which, if two ships, A and B, are approaching each other on such courses that B is over two points abaft the beam of A, then B is considered to be the overtaking vessel. An important point to be determined is whether, when the two ships straightened out on their courses, the "Hawke" was over or below two points abaft of the "Olympic." If she was forward of this bearing, the responsibility for the disaster lies with the bigger vessel; if she was abaft then she was the overtaking vessel, and if it can be proved that she was steaming faster than the "Olympic's" 17 to 18 knots, upon the "Hawke" lies the responsibility.

In conclusion we may add that whoever may pay the bill for this costly mishap, its effect upon the safety of travel will be excellent; for one of the amazing facts brought out at the Admiralty Court was the ignorance, professed or real, of many maritime officers of long experience of even the existence of such a thing as "suction." The sooner such ignorance is dispelled the better for the safety of the traveling public.

## Engineering

**Road Improvement in the United States.**—We shall look forward with much interest to the figures of the mileage and cost of improved and unimproved roads in the United States which will constitute the results of an investigation begun by the Office of Public Roads some two years ago. An investigation made in 1905 showed that in the United States, exclusive of Alaska and the Insular possessions, there were 2,151,379 miles of public roads. In 1909 there were 2,199,387 miles. During the five years the percentage of improved roads increased from 7.14 to 8.66 per cent.

**The Longest Span Riveted Bridge Yet Constructed.**—It is claimed for the new double-deck bridge which is now approaching completion across the Missouri River at Kansas City that it is the longest span riveted bridge as yet constructed, the length of the main span being 425 feet. The striking novelty of the structure is the fact that the lower platform can be raised against the floor by means of power-operated cables, drums and concrete counterweights. The vertical travel of the platform is 46 feet, and it is raised and lowered by two 250-horse-power motors.

**A Gatun Dam Criticism.**—A rather severe criticism of the Gatun dam, recently made before a joint meeting of certain western engineering societies, was based on the fact that the rock fills forming the up and down stream toes of the dam are so heavy, that they are sure to compress the underlying natural ground and cause dangerous settlement of the dam. But what if it does settle? The foundation material will be so much the more compacted and so much the more proof against seepage. Settlements occurring during construction can always be compensated by fresh filling, and this process will be carried on until the dam has been raised to its full height.

**Growth in Size of the Turbine.**—The application of the turbine to marine propellers commenced in 1897, at a period when the efficiency of the new prime mover had been well established. The famous little "Turbinia" of 1897, 100 feet in length, which was driven at 32.75 knots by turbines of 2,300 horse-power, showed a steam consumption per shaft horse-power per hour, for all purposes, of 15 pounds. In 1905 the cruiser "Amethyst" was driven by turbines of 14,000 horse-power at a speed of 23.63 knots, with a steam consumption of 16.6 pounds per shaft horse-power per hour for all purposes, and in 1907 the "Mauretania" and "Lusitania," with turbines of 74,000 horse-power, made 26 knots, with a steam consumption, for all purposes, of 14.4 pounds per shaft horse-power.

**Running Trains on Time.**—The West of France State Railway has devised a method of bringing trains to their destination on time which must surely appeal more to a Frenchman's sense of humor than to his convenience. Instead of accelerating the speed of trains which have been notoriously behind time, the officials of this road, who happen to be government officials, have adopted the naive plan of starting the trains as much earlier as the average time by which they have been late. The *Standard* of London, commenting on the matter, says: "Whereas hitherto the stipulated times of departures and arrivals were purely mythical, they will henceforth be statements of fact, unless, of course, it should again become necessary to apply brake-power to the—time table."

**Standpipe Failure in Wisconsin.**—A standpipe 20 feet in diameter and about 150 feet in height suddenly collapsed on January 15th at Sheboygan, Wis. The failure occurred after a stretch of unusually cold weather, during which the maximum temperature was +23 deg. Fahr., and the minimum —22 deg. Fahr. The effect of the cold was to cause a gradual freezing of the water inwardly from the shell, while on the surface of the water itself an ice cap formed. Ultimately the water column was entirely inclosed within a shell of ice, and the pressure eventually burst the standpipe at a point where a slight fracture already existed. The moral of this accident is that particular care should be taken in very severe weather to prevent, as far as possible, the forming of such an ice envelope in standpipe towers.

**One Million Horse-power Hydro-electric Plant.**—The success of the great hydro-electric power plants is prompting the construction of even larger plants than any in existence, the largest of which is that under construction at Keokuk, Iowa, where a dam is being thrown entirely across the Mississippi River. Recent dispatches from Montreal state that a company has been formed for the construction of a one million-horse-power plant, by damming the water which now flows through the Coteau Cascade, Split Rock and Cedar Rapids, from Lake St. Francis to Lake St. Louis and the St. Lawrence River. The Rapids will be obliterated and the flow of the waterway will be diverted about half a mile from its present course into the Ottawa. The water will be impounded by means of a system of earthen embankments and concrete dams.

## Electricity

**Wireless from Spitzbergen.**—The first press telegrams from Spitzbergen were received in Christiania on November 30th, 1911. The wireless station at that far northern place has also been in communication from time to time with Norddeich, Germany; Poldhu, England; and Paris. It is reported that 150 persons are spending the present winter in Spitzbergen, including six women and two children.

**Wisconsin Water Power Law Unconstitutional.**—Last summer the State of Wisconsin passed a law repealing all previous laws relating to water power rights and vesting these rights in the State. It was claimed that the State had the right to do this, owing to the fact that it had control over all the navigable streams, and the word "navigable" was stretched to include any stream of water which could carry even row boats or floating logs. This radical law has just been declared unconstitutional by the Supreme Court of the State.

**Hydro-electric Plants on the Los Angeles Aqueduct.**—Along the 250-mile aqueduct which is to deliver water from Owens River to Los Angeles provision has been made for seven power plants with a combined capacity of 138,000 kilowatts. The first one to be equipped is that at San Francisquito, 47 miles from Los Angeles. Three 9,375-kilowatt, 6,600-volt, 50-cycle, 3-phase water-wheel generators will be installed here. These will run at 200 revolutions per minute. The current will be transmitted to Los Angeles.

**San Francisco Submarine Power Cable.**—The work of laying 20,000 feet of six-inch cable, from the Oakland shore line to San Francisco has been completed. Now the distributing stations of the Great Western Power Company and the City Electric Company of San Francisco are directly connected. The cable will carry 5,000 kilowatts. It is protected by two sheaths of metal, one of lead and the other of steel, with a compound between. The cost approximates $250,000. With the new cable in working order, the service will be greatly improved, as both light and power will be directly supplied from the main station on the Feather River, 160 miles away.

**Electric Railway to the Summit of Popocatepetl.**—It has been announced that an English syndicate contemplates the building of an electric railway from the City of Mexico to Puebla, with a branch line running up to the summit of Mount Popocatepetl. This famous old volcano rises to a height of two miles above the City of Mexico, reaching far above the snow line. At the summit, 17,794 feet above the sea, a large hotel is to be built. The power of the line will be supplied from the Necaxa hydro-electric plant. This line will not only be used for passengers, but for transporting the sulphur mined from the crater of Mount Popocatepetl. The use of electricity for obtaining the sulphur from the crater will mark a distinct advance over the present primitive methods. According to recent estimates, there are 148,000,000 tons of sulphur in this deposit.

**Taxicab Telephone System.**—The Pittsburgh Taxicab Company has found that it does not use its taxicabs to the best advantage, owing to the fact that it is impossible to communicate with the drivers after they have started out with a fare. Frequently the taxicab carries a fare to a remote part of the city and then must return empty, while another taxicab is sent to a neighboring section of the city for another fare. If a means were provided for communicating with the first taxicab, it would not be necessary for it to return empty. Thus there would be a considerable reduction of what is known as "dead" mileage. For this reason a telephone system is being installed, with telephone boxes placed at various points throughout the city, so that the driver of the taxicab may communicate with the central station of the taxicab company before returning, in order to determine whether he may not pick up another fare on the way back.

**Electric Heat in Norway and Sweden.**—The Scandinavian countries of Europe use for the heating of their rooms large tiled stoves that are built into the place. Wood is burnt in these stoves, and when reduced to glowing embers the dampers are closed so as to confine the heat. It then radiates slowly and serves to keep the room warm for from twelve to fifteen hours. In order to make use of power during the "off-peak" hours, the hydro-electric stations of Sweden and Norway have developed electric heating devices, adapted to be placed in the tiled stoves to take the place of the wood fuel. These heating devices will generate enough heat to keep a room warm much longer than a single charge of wood fuel. The current can be supplied at a time that will be most convenient for the power plant, and hence it can be furnished at a comparatively small figure. It is hoped that by introducing electricity in this way an opening may also be furnished for the use of electric cooking appliances and other domestic labor-saving devices.

## Science

**Tenth International Geographical Congress.**—This congress was to have been held in Rome last autumn, but was postponed to the spring of 1912 on account of the war and the cholera. It is now announced that the political situation makes it impossible to hold the congress this spring. It will still be held in Rome, at some indefinite future date.

**The Typhoon in Formosa.**—Detailed statistics have just come to hand of the damage done by the great typhoon in Formosa, August 31st, 1911, mention of which has already been made in these columns. The loss of life was 620, injured 754, houses totally destroyed 24,880, houses badly damaged 46,284. The total property loss amounted to $1,250,000.

**A "Radium Emanatorium."**—Institutions for radium-therapy are rapidly multiplying. We have recently reported how the old town of Joachimsthal, in Bohemia, has developed into a "radium spa." Now an institution known as a "radium emanatorium" has been opened in Vienna. The treatment consists in breathing air saturated with radium emanation. It is claimed that the air thus charged has qualities identical with that existing naturally at Bad Gastein, and the treatment is prescribed in cases similar to those usually treated at that resort.

**Rocks as Reservoirs of Moisture.**—The capacity of rocks to imbibe moisture varies with their physical structure. Most of the water in rocks occurs in pores and interstices, the larger part of the world's well-water supply being derived from caverns or large cavities. Practically all rocks, however compact they may appear to the eye, have interstices and small cavities in which water may be stored. The degree of porosity of rocks varies, being highest in open textured sands, sandstones, gravels, and chalks, all of which have great capacity for imbibing water, and lowest in close textured clays, slates, marbles and granites, which have very small capacity for absorbing and transmitting water.

**Cleaning Plaster Casts.**—The cleaning of plaster casts can not very well be accomplished by simply washing with water as gypsum is to some extent dissolved by the latter. F. Rathgen of the laboratory of the Royal Museum, Berlin, recommends the use of a saturated aqueous solution of gypsum. Such a solution may be obtained by covering the bottom of a large bottle with ground gypsum and filling up with water. The whole must be left standing for a day or two, shaking occasionally. Finally the clear solution is decanted and the plaster cast immersed in the latter. After a few hours of immersion it will be an easy matter to remove any dust with the aid of a dense hairbrush; this must be done while the article is still in the water.

**Chemical Tests of Welds.**—It is impossible to determine the quality of fusion welds (oxy-acetylene or oxy-hydrogen) by a mere external examination, therefore one is dependent on the honesty of the operator. The following is a simple chemical test which may be applied to welds on steel or iron: The spot selected for the test is exposed with the aid of a file, saw or chisel, and is carefully cleaned and rubbed off with emery paper. A solution of 1 gramme of iodine and 2 grammes of potassium iodide in 10 grammes of water is then applied with a hair brush. A mixture of acetic acid, 4 parts; nitric acid, 1 part, and alcohol, 1 part, may be used instead, or the piece of metal may simply be immersed in dilute sulphuric acid (22 cubic centimeters sulphuric acid to 100 grammes water). Any cracks, flaws or blisters will thus become exposed and many "expert welders" will be made ashamed of their work.

**Modified Milk.**—The following method of modifying milk has for its object the displacing of sugar contained in the milk by glycerine. To accomplish this the process of dialysis is resorted to. The bladder or intestines of oxen, sheep, or pig (as used in the manufacture of sausage) are used as separating membrane after having been thoroughly cleaned with soap and water. A large barrel or tank, is so connected with the fire-hydrant that the inlet tube reaches nearly to the bottom of the dialyzer, while the excess of water runs off at the top. The skins are filled with the milk to be modified and immersed in the stream of water kept running through the tank during the process, which lasts from ten to twelve hours. Diffusion takes place, causing the sugar as well as the salts contained in the milk to be dissolved and removed by the circulating water. The colloids are retained by the skins. The salts may then be replaced. To each 1,000 cubic centimeters of milk are added: 1 gramme sodium chloride, 0.5 gramme calcium chloride and 5 grammes sodium phosphate (in crystals). Glycerine, which is substituted for the sugar, is added in the proportions of 5:1,000 cubic centimeters.

# Pittsburgh Trailers and Their Lessons

## Doubling the Seating Capacity for the Same Motive Power

By John P. Fox

IN Europe, where overcrowding is forbidden on street cars, two methods are in common use for furnishing sufficient seats at low cost. In England, the double-deck car is almost universal. On the Continent, trailers are more generally used. In America, where no such attempt is made to require or furnish seats as in Europe, passengers are usually all crowded into single cars.

In the early days of electric and cable traction in this country, trailers were frequently used, and their discontinuance has been a distinct loss, both to the public and the companies. For, while nothing can equal the double-deck car, with its possibility of furnishing at least twice as many seats as an ordinary car for the same cost, the trailer can still provide a very large seating capacity, at a reduced cost over single cars. A few cities, such as Washington, Pittsburgh, and Denver, still use trailers. But the most interesting recent development has been in Pittsburgh, where a new type of trailer has been in service nearly a year, which is of great importance to electric traction and the riding public. The car illustrated, of which fifty are now in use, is of the center-entrance type, with two sliding doors on each side, operated by compressed air. The small size of the wheels is one of the most conspicuous features. They are only 22 inches in diameter, and allow an unbroken floor throughout the entire length of the car, only 30 inches above the rail. This is a very important feature, as it requires only two steps up to reach the car floor from the street, helping materially to reduce the length of stops.

The Pittsburgh seats are longitudinal, of well-shaped rattan, extending round the end of the car. Folding seats are used in front of those doors which are not in service, the car being double ended, to run in either direction.

The most remarkable features of the Pittsburgh trailers are the large seating capacity and the light weight. They seat sixty-two passengers and weigh only 22,300 pounds, or 300 pounds per seat. They have the largest capacity of any city cars in America. The standard Chicago cars seat only forty, though they are four feet longer. Fifty-two seats has been the largest number found on any other closed, city car, as in Boston, Milwaukee, and Denver.

Now the largest Pittsburgh motor cars are second only to the trailers in capacity, having fifty-seven seats. This gives a motor and trailer together 119 seats. The great economy of such a unit is apparent at once. It takes only three men for the two cars, one motorman and two conductors; instead of the usual four men, where cars are operated singly. The trailer itself takes not only half as many men as a motor car, but only half the power, as the weight is less than half that of a motor car. Long experience in Europe shows that the operating cost of a trailer may safely be taken as half that of a motor car. This makes the cost of furnishing a seat on a trailer only about one-half that on a motor car. With motors and trailers combined, the cost of a seat is obviously only two-thirds of the cost with single cars.

The full significance of the Pittsburgh cars can be seen by comparing the seats which can be furnished for a given sum, with the seats possible where only single cars are run, as in Chicago. Assuming that it costs 16 cents to operate a motor car one mile, and a trailer half as much, then a Pittsburgh motor and trailer would cost 24 cents a mile. Dividing this by the number of seats, 119, gives a cost of about 0.2 cent a seat mile. In Chicago, with only 40 seats to a car, the cost per seat mile would be 0.4 cent, or twice the expense in Pittsburgh. For 16 cents, it is possible in Pittsburgh to furnish 80 seats, in Chicago only 40. This means that if the Pittsburgh cars were in use in Chicago to-day, they could furnish just twice as many seats for the same operating expense as the present cars do now, run singly.

On the most congested streets in America, it may sometimes be impossible to furnish sufficient seats with separate single-deck cars. But the trailer affords a cheap and simple way of increasing the capacity. It can readily be seen that trailers allow about one-third more seats for the same operating cost. And besides this, on a crowded street, from 40 to 50 per cent more cars can be run, with the same space between fronts and rears, if all the cars are in pairs. The introduction of trailers, then, in a city would not only allow a large increase of seats to be furnished, without additional operating cost to a company, but also without greater congestion on the streets.

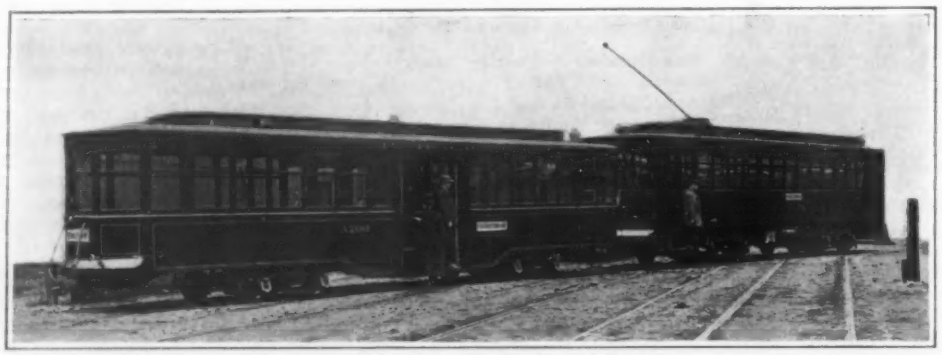
It may be interesting to consider the objections to trailers, especially in Chicago, where they formerly operated on the cable lines, but were prohibited under the new ordinances. All the possible objections to trailers can be found in the Chicago report of 1902, from which the following is taken:

"The single car operation on Broadway (New York) as well as the single car electrical operation demonstrated the superiority of the single car method. Two or more cars operated in a train decreases the frequency of cars on the street; increases the number of stops in the ratio that the larger number of passengers on the train bears to the capacity of a single car; requires more time for acceleration and retardation; in taking up the lost motion in drawbar connections due to wear, an extremely unpleasant effect is transmitted to the car; the surge in the slack of the cable communicates a jerky movement to the car; owing to the length of the train and ordinances prohibiting the blocking of crossings by cars, passengers on the forward cars are carried beyond the foot path to the sidewalk and are frequently compelled to alight in the mud; the necessity for transmitting signals through one or more hands endangers the safety of the passenger; the added weight of a train over a single car requires greater distance, more time, and more power for braking, and many collisions and accidents are traceable to train operation that would not happen under single car operation; congestion in crowded thoroughfares is increased through the continuous occupation of space. The foregoing are a few of the disadvantages of train operation. There is nothing to be said in favor of the method, not even from an ownership standpoint. The money saved in wages is more than dissipated in the accident account. Nearly all of the objectionable features to train operation by cable power apply to train operation by electric power, and the operation of trailers on electric motors should be discouraged."

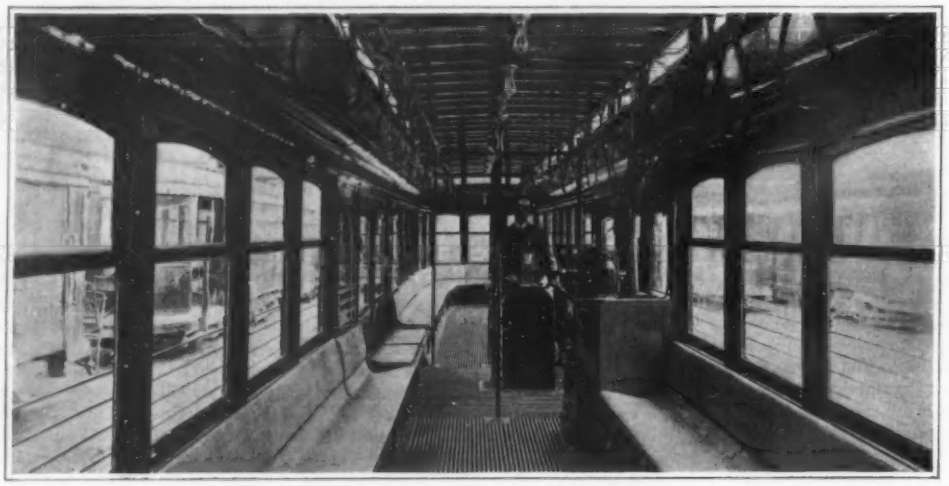
It would hardly be possible to write a more severe arraignment of trailers than this. And yet, however unsatisfactory cable trailers may have been in Chicago in 1902, practically none of these objections hold to-day, with the latest cars in Pittsburgh or in European cities. The Pittsburgh motor cars have sufficiently large motors, so that acceleration is rapid, and cars can be run on schedule time. All trailers have automatic air brakes, allowing quick stops, and instant stoppage of both cars if they should pull apart. The coupling springs are sufficiently strong to prevent jerks in starting. All cars in Pittsburgh stop only on the near side of streets, so that passengers can never alight on a crosswalk anyway. Moreover, the city of Pittsburgh has pavements on all the streets where cars are run, and these pavements are kept free of both mud and snow by a highly efficient street cleaning force. Other cities ought to get similar results. The Pittsburgh trailers do not cause more accidents, though they have no chains or springs to keep people out from between the cars. No difficulty comes from signaling between two cars; and what are two cars compared with an eight-car New York subway train? The Pittsburgh trailers do not delay the motor cars at stops, because they appear always ready to start before the motor car. The low steps and wide doors have resulted in one of the quickest loading cars in use in the country, even though passengers must pay on entering, and deposit their money in a fare box. For ordinary stops, one doorway is used for entrance and one for exit; but both doors are often used for either purpose if there is a crowd to get on or off. The lack of cross seats may be criticised, but they could be used perfectly well, and allow a gain of about eight seats, or a total of 70 seats in all.

It looks as though all the objections raised in 1902 have been met in Pittsburgh, and that the time has come when trailers should be considered everywhere, even in Chicago, again. Of course, it is simpler for a company to crowd passengers into single cars than to provide additional seats with trailers. The latter do introduce complexities, as they have to be coupled and uncoupled twice a day, reversed at the end of some lines, and these things require thought and planning. But city transit is very complicated anyway; and the economy of trailer operation, the good policy of furnishing more seats, and the interest in working out the new problems, all make the trailer worth the slight additional trouble.

In the Chicago traction settlement the companies have gained in having new tracks, new cars, better light and ventilation, through routes and other advantages, but they have not reduced overcrowding.



Pittsburgh motor and trailer providing one hundred and nineteen seats in a single unit.



Interior of Pittsburgh trailer which provides sixty-two seats.

PITTSBURGH TRAILER CARS AND THEIR LESSONS

# The Late Joseph Lister

## The Father of Antiseptic Surgery

By John B. Huber, A.M., M.D.

FOR a just appreciation of the life work of Joseph Baron Lister, we should first consider what surgery was before he began his epoch-making career, and until his discovery had gained the general acceptance of his colleagues.

Before the coming of anesthesia, the elder sister of antisepsis, in 1846, the surgical field was, by comparison with its expanse to-day, exceedingly limited. Those who operated were men whose knowledge of the human anatomy was well nigh perfect, men of marvelous skill and courage; they oftentimes thrilled the amphitheater where they worked to tremendous excitement; it is written (nor need we doubt the record) that patients collapsed and died "on the table" of terror at the first incision; operations were amazingly rapid, by reason that the patient had to suffer, without relief, the psychic shock and the frightful agony inflicted by the knife, the saw and the necessary manipulations. Every second saved was incalculably precious. In these circumstances there was naturally lacking the exquisite technic characteristic of present-day surgery; for the lethal state of the patient now precludes the necessity of haste. But all such shock and torture were obviated for the patient when the dentist Morton successfully gave ether in the Massachusetts General Hospital on October 16th, 1846, the date now appropriately celebrated in Boston as "Ether Day;" and almost simultaneous with this came the discovery of chloroform by the Scotchman Simpson.

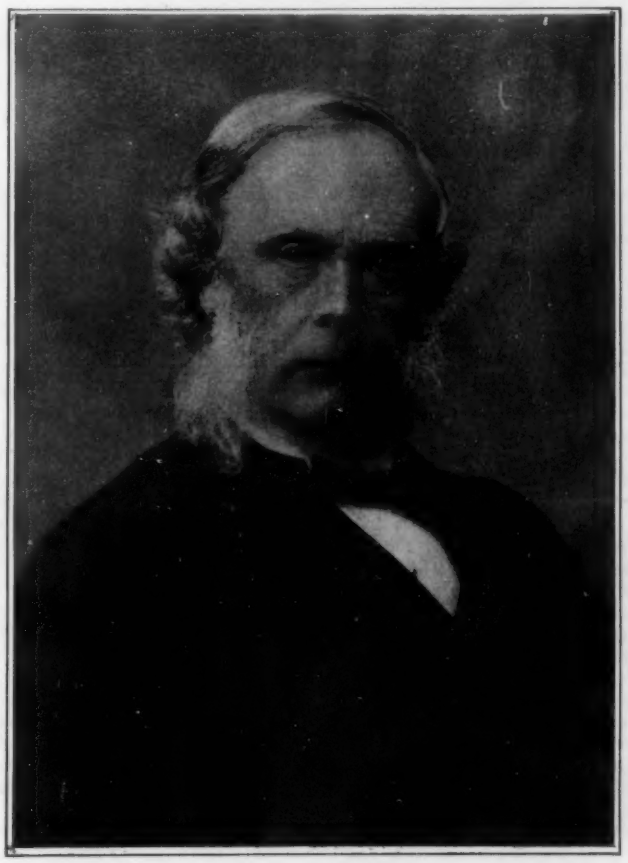
But even the blessed advent of anesthesia by no means rid surgery of all its terrors; to this end she needed the aid of her younger sister antisepsis. The torture of the operation was abolished; but there was dreadful after suffering, and all too frequently did death follow. Those who served in hospitals had to dress wounds after operation—wounds reeking with pus, gangrenous, and saturated with the germs of erysipelas, tetanus, pyemia and septicæmia. Then did hospital fever reap its dreadful harvest. In those rare cases when "primary union" was obtained, without a drop of pus, without fever and with but little torture to the patient, it was rightly held to be a wonderful achievement. Such was the status of surgery before 1870—about the time of Lister's first demonstration of his methods of antisepsis.

Every great discovery is, as it were, the apex of a pyramid; it is the culmination, in the genius of an innovator, of the thought and contributions of many preceding laborers in the devoted service of mankind. As early as 1840, Semmelweiss, in Vienna, considered puerperal fever an infectious disease, though he could not prove it in the present-day sense; in the hospitals of that city women in childbirth were dying in enormous numbers because of the infected atmosphere of these institutions—but even more so, it would seem, by reason that physicians coming from cases of scarlet fever or diphtheria or typhus were not scrupulous in such ordinary precautions of cleanliness as the washing of their hands. Semmelweiss practised strict cleanliness and the use of calcium chloride, and thus reduced the death rate among his own cases from 12 to 1.2 per cent. The contemporaries in his profession were merciless in their scorn and abuse of him; he had offered a boon and had naturally expected its loyal acceptance by his unwashed colleagues; his sensitive soul broke down under the vituperation he received instead, and he died in a madhouse. More fortunate in his advocacy of similar views was Oliver Wendell Holmes, the great physician and philosopher. Holmes, in 1843, maintained, as did Semmelweiss, the infectiousness of puerperal fever. In 1844 Litzmann characterized it as "a febrile miasmo-contagious disease peculiar to puerperal women." Yet so slowly are such lessons learned that even recent years have not infrequently seen their cases of this dreadful disease; and it is computed that between 1816 and 1875 Europe had 170,000 cholera deaths, 165,000 variola deaths and 363,600 deaths from childbed fever.

Tyndall noted (as might anyone else) that solar light, in passing through a dark room, reveals its track by illuminating the dust floating in the air; but with the intuition of genius (which everyone has not) he recalled the statement of Daniel Culverwell that "the sun discovers atomes, though they be insensible by candle light and makes them dance naked in his beams." Tyndall, in his researches on the decomposition of vapors by light, was compelled to remove these "atomes" and this dust. It was essential for his experiment that the space containing the vapors should contain no visible thing—that no substance capable of scattering the light in the slightest sensible degree should be found in the tube traversed by the luminous beam. He tried ineffectually various means for the elimination of this floating matter, which was *not*, by the way, visible in the exhausted, vacuous experiment tube. But on one occasion, prior to sending the air through the apparatus, he carefully permitted the former to pass over the flame of a spirit lamp; whereupon the floating matter no longer appeared in the experiment tube. It had been burned up by the flame, and was therefore organic matter. Tyndall did not then know the precise nature of this organic matter; but his scientific acumen led him to find here some relation with the researches of such workers as Davaine and Pasteur. Davaine, in France, had in 1863 discovered little rod-like bodies in the blood in wool-sorters' disease (anthrax); and he names these "little rods" "bacteria," after a Greek word descriptive of their shape. This term is now adopted for all germs or micro-organisms. In 1865 Pasteur demonstrated the bacterial origin of pebrine, the silk worm disease, and his finding was violently opposed by those who believed in spontaneous evolution. Tyndall then, for his part, "sensed" that these "atomes" or bacteria or "particulates," as he termed them, were entities not at all identical with units of unvitalized matter. With Pasteur he believed that they were organic and had life; that they were self-multiplying (which phenomenon explains infection); that, however minute they might be, they must partake of the property of vital things and must be differentiated into species, each propagating its own kind and none other. We shall not get figs from thistles, nor thorns from grapes. "If you sow wheat you do not get barley; if you sow smallpox you do not get scarlet fever; the matter of each infectious disease reproduces itself as rigidly as if it were dog or cat."

Such findings as these did Lister infuse with his genius and appropriate to his beneficent ends; it was upon them that he based the principles of antisepsis.

Joseph Lister was graduated in medicine in 1852; from 1869 to 1877 he held the chair of Clinical Surgery in the University of Edinburgh. But years before he began this incumbency he had given thought and had experimented, to the end that germinal infection might be kept from wounds. Carbolic acid was a discovery of that era, and Lister used it as a germicide. His first application of antisepsis was made in the treatment of compound fractures. His conviction was that the impregnated air which reached the wound caused the infection; and he conceived the problem to lie in protecting the wound from the air. He therefore first cleansed the affected region with carbolic acid and then dressed the wound with lint soaked in the acid. His surprising success in this treatment led to its employment in flesh wounds generally and in abscesses. But finding pure carbolic acid unduly irritant and poisonous when absorbed from wounds extensive in area, he next prepared "Lister's antiseptic putty," which was compounded of linseed oil, carbonate of lime and carbolic acid. Here began surgery in the modern sense. Both Tyndall and Pasteur had previously found cotton wool to be an effective means for intercepting bacteria, infusoria and the like, while at the same time germ-free air might pass through. Lister's next important step then was upon this basis to cover wounds not with cotton, but with sterilized gauze. He thus introduced asepsis—exemption from putrefaction.



Joseph Lister

So, even before the discovery of the bacteria of suppuration (1881), of erysipelas (1883), and tetanus (1887), did Lister prove that by surgical cleanliness all infection could be avoided. The mortality of compound fractures in the pre-antiseptic days was about 60 per cent; it was the most dreaded of all accidents; its mortality now rarely exceeds three per cent, and sepsis (blood poisoning) after such fractures is now practically *nil*. Before Lister's day the mortality from major operations varied from 50 to 63 per cent; it now seldom exceeds 10 per cent.

Believing that the pathogenic bacteria existed chiefly in the air, Lister prepared apparatus for spraying carbolic acid near the region of the wound; but while such bacteria certainly do exist in this medium, he later found, with others, that the air is not the only (nor, indeed, the chief) source of infection. Unsterilized dressings, sponges, instruments, clothing, were also discovered to be sources of putrefaction. So the use of the spray was abandoned; and the most scrupulous "surgical cleanliness" was instituted with regard to any substance that might possibly come in contact with a wound. The surgeon now seeks to be rid not only of the dirt that can be seen, but also of the microscopic dirt that cannot be seen. No one can touch a wound howsoever lightly with ordinarily clean hands without infecting it.

After eight years of teaching, which was oftentimes received with an "indulgent smile"; after eight years of operations, amazingly successful, based upon the antiseptic principle, Lister's views were accepted and followed in Scotland, "after a fashion." He was much more appreciated in Germany and America than in England. And we may well agree with Dr. Keen, who wrote a decade ago that "when the profession arose *en masse*, within the last few years, at the International Congress of Berlin, and at the meeting of the British Medical Association in Montreal, and welcomed him with cheer after cheer, it was but a feeble expression of gratitude for benefits which no words can express."

The infectionless operation, coupled with anesthesia, has increased the range of surgery beyond the wildest dreams of those who labored in this field but thirty

(Concluded on page 185.)

# A New Apparatus for Marine Exploration

## Recently Invented Deep-sea Nets

By Prof. Charles A. Kofoid, of the University of California

THE clear water of the open sea, even to considerable depths, has been found by the explorations of the "Challenger" expedition of the British government, by the German Deep Sea Expedition of the "Valdivia," and especially by the explorations of the United States steamers, "Blake" and "Albatross," conducted during the past thirty years in the Atlantic and Pacific oceans under the direction of the late Alexander Agassiz, to be more or less densely populated by pelagic animals and microscopic plants or their remains, of remarkable interest and beauty, and one of the questions raised by these explorations has been as to the depths in the sea to which these organisms descend, or at least are abundant. A second group of problems cluster about the reactions of pelagic organisms to light, as shown by their regular accumulation at or near the surface of the sea shortly after twilight and their descent again as the evening wanes, with a tendency to gather again, in some instances, at the surface during the morning twilight. During the day they seek again the darkness of the deeper waters, sinking in some cases to depths of half a mile.

The study of the vertical distribution and vertical migrations of these organisms has opened up a fascinating field of investigation in the physiology of the sea and has called forth the invention of a considerable number of nets devised to be opened and closed at desired depths by the operator on shipboard. This opening and closing of the nets in the depths has been accomplished either by propellers set in motion by the movements of the net or by weights slid down the cable which release the mechanism upon striking the apparatus, or even by sliding the whole net down the cable, as in the case of the Prince of Monaco's curtain closing-net, and opening it by impact with the terminal weight. Other nets have been devised, but seemingly never actually successfully constructed, to be operated by the pressure of superimposed sea water acting upon the mechanism of opening and closure. Obviously the construction and maintenance of apparatus by such a method is exceedingly difficult.

Most of the closing nets devised for deep-sea work have thus far been operated in the vertical direction, such for example as the Nansen closing-net used extensively by the International Council for the Investigation of the Sea, or the trap devised by Capt. C. D. Sigsbee for use on the United States Coast Survey steamer "Blake," the Tanner net devised by Capt. Tanner of the "Albatross," and the Townsend closing-nets invented by Mr. C. H. Townsend when he was naturalist on the latter named vessel. In order to obtain any considerable sample of submarine life it is necessary for the vertical net to traverse a considerable zone of water. This fact makes it impracticable to use this type of net in the exploration of levels of narrow width, a matter of considerable importance in the study of migrations of organisms and of stratified waters, where, owing to submarine currents, the character of the water changes abruptly in temperature, salinity, and in the nature and extent of its population.

The net here described is designed to be towed horizontally at the end of a steel cable and to be opened by a heavy messenger or weight slid down the cable by the operator on shipboard when the net has reached the desired depths. After towing in a horizontal position for the desired time or distance the net is again closed by a second messenger and then hoisted upon deck with its sample of life from the desired level safely locked within the silken bag free from admixture with organisms from other levels than the one whose exploration is desired. With such a net it is possible to explore with certainty and exactness the life, for example, at the depth at which the rays of light of the various parts of the spectrum are absorbed, or to follow the vertical movements of the food of the mackerel hour by hour throughout the day.

The net maintains its horizontal position by virtue of its considerable weight (180 pounds), which at a slow rate of movement will suffice to keep it in a nearly vertical position during towing by the ⅜-inch steel cable used to handle the net on the "Alexander Agassiz," the vessel of the San Diego Marine Biological Station of the University of California. Additional weights may be added, if needed, to the flat-iron shaped casting which forms the foot of the net.

The net is of the hinged-jaw type with circular opening 37 centimeters in diameter with two semicircular jaws beveled to fit snugly when closed, turning on axles in the lateral chambers of the frame. The strong springs which actuate the jaws are inclosed within the hubs about the axles which are held in place in the hubs by adjustable set-screws which hold the axles at the position giving the desired tension on the springs. The upper jaw is actuated by the spring of the right side, the lower by that of the left. Each hub consists of an outer and an inner sleeve continuous (in reversed relations in the two hubs) with the jaws, which provide for their movements in opening and closing.

When the net is lowered both of the jaws are held in the upper position by clutches which pass through the head piece and project as pins above. In this position the mouth of the net is tightly closed. The first messenger employed strikes the more centrally located pin and releases the outer jaw which is swung to the lower position by the spring in one hub. The net is then open and may be towed horizontally. The accumulated catch is held within the net when the second messenger strikes the outer pin and releases the second clutch and permits the upper jaw to fall outward and downward, thus finally closing the net tightly. The spring in the other hub makes this closure quickly and effectively, and maintains it during the ascent of the net.

The operation of the net is thus completely under the control of the investigator, both as to the level at which the net operates (except for deflection due to speed of towing) and as to the time of opening and closing. The closure cannot, however, be interfered with by any extraneous factors such as the surge of the ship.

When received on shipboard the bag with the rim to which it is attached may be removed from the frame by dropping gates directly on the front of the hubs, and its contents washed down and condensed in the filtering bucket at the tip of the bag and removed to suitable containers for purposes of examination and preservation.

The cable to which the frame is attached can be slipped into place in the center of the head-piece through a slot in the front and its terminal eye locked in place upon the steel bolt (with ring at left). Accumulator springs in the supporting arm for the silk bag permit this to assume a more nearly vertical position during ascent and descent of the apparatus. The net here described was constructed for the San Diego Marine Biological Association of the University of California after designs by the writer, and has been in successful operation for the past three years to depths of 550 fathoms.

A second piece of deep-sea apparatus, also devised by the writer, is a self-closing water bucket designed to secure twenty liters of sea-water from any desired level for biological examination or analysis of its contained salts or gases. The apparatus mentioned consists of a frame with head piece and base connected by four standards upon two of which slide a brass cylinder and lid. The apparatus is lowered as shown at the left with the lid and the cylinder suspended by clutches to the head. The water freely circulates through the cylinder during descent. When the desired level is reached a messenger is dropped down the cable upon the clutches releasing the lid and suspended cylinder which fall into place on the base and inclose the contained water. Beveled faces of contacts of lid, cylinder and base insure water-tight closure. A faucet, which serves also as a key, provides for removal of the contents. A removable plug in the lid permits the insertion of a thermometer, though the apparatus cannot be used for temperature work at considerable depths on account of heating by friction during transit. An insulated central core could, however, be readily added to the apparatus as in the Petterssen water-bottle.

The cable to the end of which the bucket is attached is passed into the center of the head-piece through a slot with lock-closure, and fastened in the axis by a sliding steel bolt. When filled the apparatus weighs about eighty pounds.

## An Arithmetical "Nut"

FIVE men and one monkey spent a day gathering a large number of cocoanuts.

At night, all being very tired, they postponed an equable division of the result of the day's work and made camp, and went to sleep.

Awaking after an hour and distrusting his mates, Mr. A. arose, counted the nuts, divided them into five parts, secreted his own fifth, and finding there was one nut too many in the total number for an equal division by five, gave the odd nut to the monkey. He then put the remaining four-fifths of the nuts in a pile and went to sleep.

In a short time, Mr. B. awoke, had the same suspicions of his mates, and, unknowing that any one had been before him, divided the remaining pile into five parts, found one over, gave it to the monkey (who now had two nuts), secreted his own little pile, mixed the remaining large pile up, and went to sleep.

In like manner, at intervals throughout the night, Mr. C., Mr. D., and Mr. E. did the same, each dividing the remaining pile, subtracting his own fifth, and each finding one over, which each gave to the monkey.

In the morning they all fell to upon the pile, divided it into five parts, and finding none over, decided that nuts were not good for monkeys anyway. The monkey secreted the five he had been given at night and said nothing.

How many nuts were there in the original pile?

It should be stated that the arithmetical process by which this puzzle is solved is of the simplest variety, which any school boy of ten or twelve knows well, and that the correct answer can be reached with a pencil and paper in less than one minute—if you know how!

Lest you puzzle too long, let it be said that five, the total number of men, is to be raised to the fifth power, thus: $5 \times 5 \times 5 \times 5 \times 5$. This works out this way:

$$5 \times 5 = 25$$
$$5 \times 25 = 125$$
$$5 \times 125 = 625$$
$$5 \times 625 = 3{,}125$$

This sum, divisible by five, would allow each man to take a fifth, a fifth of the four-fifths remaining, and so on; but so would any other large multiple of five. It must not be forgotten that there was one nut left over after each division of the spoils, save the last one, which was given to the monkey.

The least number which can be subtracted from 3,125 and leave it divisible by five with one left over, is four. Consequently, four is subtracted from 3,125, leaving 3,121 as the total number of cocoanuts in the pile.

Let us see how that works out. Mr. A. divided the pile into five equal parts and found one left over, which he gave to the monkey. He thus took 624 nuts for himself, but took 625 from the pile, leaving 2,496 nuts. Mr. B. divided this into five equal parts, taking 499 for himself and giving one to the monkey. He thus took 500 nuts from the pile, which now totaled 1,996. Mr. C. woke up, divided the pile into fifths, getting 399 nuts for himself and giving one to the monkey, thus subtracting 400 nuts and leaving 1,596 in the pile. Mr. D. divided this pile into fifths, taking 319 nuts and giving one to the monkey, thus removing 320 nuts from the pile, which now had only 1,276 nuts in it. Mr. E., the last one to wake (one suspects he gathered the most nuts and so was most tired) divided the pile into fifths, taking 255 for himself, and giving the odd one to the monkey. He thus took 256 nuts from the pile, which contained 1,020 in the morning. They all divided this into fifths, each getting 204, there being none over for the monkey.

The little sum "proves" very easily by adding together the nuts each man took for himself and those he received in the morning, making a grand total, and adding the monkey's five, thus:

| | |
|---|---|
| Mr. A. took in night | 624 |
| Mr. A. received in morning | 204 |
| Mr. B. took in night | 499 |
| Mr. B. received in morning | 204 |
| Mr. C. took in night | 399 |
| Mr. C. received in morning | 204 |
| Mr. D. took in night | 319 |
| Mr. D. received in morning | 204 |
| Mr. E. took in night | 255 |
| Mr. E. received in morning | 204 |
| Given to the monkey | 5 |
| Total nuts to begin with | 3,121 |

# Trees That Yield Butter

## How Nature Competes With the Dairy

By W. R. Gerard

BUTTER, as the term (from a Greek word meaning "ox-cheese") implies, was originally a name for a product obtained from the milk of the cow, and afterward, by extension, for a like substance obtained from the milk of other animals such as the ewe and the goat. By a further extension, the name has been applied to certain fixed vegetable oils, the melting point, consistency and aspect of which resemble butter of animal origin, such as "butter of cocoa," a concrete oil of a sweet and agreeable taste obtained from the kernels of the fruit of *Theobroma cacao* or "chocolate-nut tree;" "butter of Bambuk," an oil obtained from a species of almond in Senegal, and used medicinally; and "butter of nutmegs" or "butter of mace," a sebaceous substance expressed in the East Indies from the arillus of the fruit of *Myristica moschata*.

To the plants yielding such oils has been applied the name of "butter-trees," and to the oils themselves the term "vegetable butter." The "butter-tree" of Nepal is the *Bassia butyracea*, the seeds of which yield by pressure a semi-solid oil, which thickens and becomes of the consistency of lard. It is called "phoolma," "chorce," or "vegetable butter," and is used for culinary purposes, and, by the natives of rank, for anointing the body. The seed of *Bassia latifolia*, the "mahwa-tree" of Bengal, yield a greenish-white oil which is of the consistency of butter, and which is used as such by the poorer classes. From the flowers of the tree is distilled a spirit resembling whisky, which the natives like better, and consume in large quantities. Another species of the same genus, *B. longifolia*, the illupie-tree, affords an oil similar to that obtained from the two preceding trees, and which is used by the Ceylonese for culinary purposes. The "butter-tree" of Africa, the seeds of which produce the "galam butter" or "shea butter" mentioned by Mungo Park in his travels, is a species of the same genus, *B. Parkii*. The fruit when ripe is of the size of a peach, and, after being dried in the sun, is pounded in a mortar until reduced to flour. It is then mixed with water and boiled for a short time, when greasy particles become detached and rise to the surface, whence they are then skimmed. When cold the oil is of the consistency of butter and will keep fresh for two years. It has an agreeable taste, is used as food, and is an article of considerable trade with the natives of western Africa. The "butter and tallow tree" of Sierra Leone and other parts of west tropical Africa is *Pentadesma butyracea*, the "kamoot tree," or "kanya tree." From the seeds of this, the natives extract an oil called "kanya butter," which is used by them for cooking. The butter is extracted by drying and parching the seeds, then pounding and boiling them, and skimming off the supernatant oil. A yellow greasy juice is given out freely when the fruit is cut or opened. The oil has a terebenthene flavor, and is therefore not relished by the English settlers. It is sold as butter in the markets of Freetown.

*Garcinia pictoria*, a tree abundant in Mysore and the western coast jungles, yields the pigment gamboge, but is more important for the oil obtained from the fruit and called "gamboge butter." An allied species, *G. purpurea*, furnishes a similar oil called "cocum butter." These oil butters are obtained by pounding the seeds, boiling them, and skimming off the floating grease. They are used as substitutes for butter as well as oil for lamps.

*Combretum butyraceum*, called by the Kaffirs "chignite," a climbing shrub or tree of the Myrobalan family, and a native of southeastern Africa, yields (whether from the fruit or bark is not known) a white, butter-like aromatic substance which is taken to Mozambique as an article of commerce.

The *Elæis guineensis*, the palm which yields the palm oil of commerce, is a native of tropical western Africa. The part yielding the oil is the outer fleshy coating of the fruit, but the seed, which is inclosed in a hard shell, likewise affords an oil. Commercial palm oil is of about the consistency of butter, of a bright orange-red color, and of a pleasant violet-like odor when fresh. In Europe and America it is largely used for making soap, but in Africa it is eaten as butter.

"Cocoa butter" is a fatty concrete substance obtained by boiling and pressing the white kernel of the nut (albumen) of the "cocoa-nut palm," *Cocos nucifera*. The oil is liquid at the ordinary temperature in tropical countries, and, while fresh, is used in cooking; but in this country it is semi-solid and generally has a somewhat rancid smell and taste. The seeds of an allied species, *C. butyracea*, a native of New Grenada, likewise yield a butter in the form of a semi-solid oil. Several related species give analogous products that bear the name of "copral" when the nuts, broken and dried in the sun, are sent from central Africa, through Zanzibar. This contains 80 per cent of oil which, when extracted, is used in the manufacture of soap. "Butter of canara" is an oil obtained from the fruits of *Vateria indica*, a tree indigenous to the Malabar coast. It is a vegetable butter of solid consistence, beautifully white, and requires a higher temperature to melt it than animal tallow. Candles made from it burn with a clear light, and produce an agreeable fragrance.

The "japuru butter" tree, *Erisma Japuru*, of Brazil, is a noble tree growing on the banks of the Upper Rio Negro and Uaupes, and which bears red fruits of which the kernels are pleasant eating, both raw and boiled. Butter is prepared from these as follows: After having been boiled from morning till night, they are well covered up, and put into baskets in running water, where they are allowed to remain two or three weeks. When, at the end of this period, they are spread out, they emit a disagreeable stercoraceous odor. They are then beaten in a mortar until they have the appearance and consistence of pale butter. To receive this, a large cylindrical basket is made of strips of the trunk of a palm and lined with leaves. The basket is placed on a stage over a fire where it is usual to put things that need to be kept dry, and there the butter will keep good for two or three years. "Japuru butter" is eaten with fish and game, being melted in the gravy along with the fruits of various species of *Capsicum*, which constitute an essential ingredient in the *mohlo* at every Brazilian table, whether the guests be red or white. People who can endure the vile smell, which is never lost, find the butter very savory.

The fruit of *Persea gratissima*, the "avocado" or "alligator pear" of the English, or "palta" of the Peruvians, contains a large amount of a firm, unctuous, oily pulp having exactly the taste and appearance of yellow butter, and is frequently called by the English residents of the West Indies "midshipman's butter" or "subaltern's butter." It is usually eaten with spice and lime juice or pepper and salt. An abundance of oil useful for illuminating purposes and for soap making is obtained from the pulp by expression.

What is called by the French "beurre de mango," and by the English "mango butter," is a fatty matter obtained from a species of *Mangifera* of the order Anacardiaceæ.

Finally, a substitute for butter is afforded by the yellowish fatty pulp contained in the edible fruit of the "mucuja palm," a tree forty feet in height growing on the mainland of the Lower Amazons. This oily pulp, which is eaten, is sold in the markets throughout Brazil.

## The Berlin Museum of German Industry

**By the Berlin Correspondent of the Scientific American**

WHILE resembling in many ways the German Museum at Munich, the Museum of German Industry now being founded in Berlin will be based on different principles. So far from containing collections of actual machines and instruments, it will, in fact, comprise vast archives of photographs—plain and colored—cinematograph films and artistic reproductions, illustrating the whole of modern industry in its various phases and keeping the engineer as well as the man in the street abreast of the latest progress. The production and utilization of raw materials, operation of metallurgical and machine works, the installation of machine shops, processes and products of manufacture and their uses, as well as all kinds of engineering works (for the utilization of the forces of nature, irrigation, draining and transporting plants, water, gas and electricity supply systems, etc.) will be illustrated in a most comprehensive and interesting manner. While constituting an excellent means of acquainting the general public with the trend and achievements of engineering, the museum is mainly intended for professional purposes. Its manifold exhibits incidentally constitute an excellent advertising scheme.

Besides these classified pictures representing machines, apparatus, instruments, tools, etc., there will be a central office for supplying all kinds of trade matter. Lectures will be held whenever required.

The museum will be mainly divided into three departments. On the one hand, there will be photographs of all interesting objects, arranged in about a thousand technical groups and mounted on special tables, in frames allowing of a rapid inspection and exchange. Each of these photographs (of standard size) will bear a number and the constructor's name.

On the other hand, there will be held periodical exhibitions changing at short intervals—say, once a month—which by their picturesque and lucid documents will appeal to the general public. The whole space set apart for these exhibits will be divided into twenty-eight departments in which the various kinds of machines, installations and constructions of interest will be represented by lantern slides and artistic dioramas, large-sized photographs (plain or colored) and cinematograph films. For instance, the Bagdad railway will be illustrated by a collection of large photographs, showing the machines, tools and means of transport used in connection with such work, while a cinematograph will show this machinery in operation. The manifold operations in a shipyard, the weaving of fabrics in textile mills, the operation of ceramic and metallurgical works, the technical installations of an up-to-date farm (inclusive of electrical shearing machines), these and many other phases of industrial life will be presented in a most attractive form. There will finally be a technical theater to popularize the various branches of industry, inclusive of the latest progress, by moving-picture shows and lectures.

The Museum of German Industry is shortly to be inaugurated in the form of provisional collections installed at the Technical High School.

## Uses of the Castor Bean

CASTOR oil (extracted from the seeds of *Ricinus communis*) is used chiefly as a purgative. The oil is frequently administered in combination with various other substances to mask the taste. The *Bulletin* of the Imperial Institute (London) recommends the following methods of preparation among others: mixing the oil with milk and evaporating to dryness; mixing with salts of casein and milk sugar; making an emulsion with gum arabic and treating with magnesia and lecithin.

The oil is used a great deal as a lubricant in India; but on account of its high viscosity this use is generally impracticable in cold countries. Still, it is so used in combination with mineral oils for marine engines and gasoline motors. The high viscosity is an advantage in the lubrication of parts with very rapid rotation, as in motors of aeroplanes.

Soap made of castor oil has high cleaning powers, but it is never used for soap-making except in combination with other fats. The addition of castor oil tends to make the soap transparent.

In making paint-oils, the castor oil is sulphureted by treating it with concentrated sulphuric acid at a temperature below 95 deg. F., then neutralizing it with soda or ammonia. The sulphureted oil is also used in the preparation of substitutes for India rubber.

The bean of the plant contains a ferment which splits fats into glycerine and a fatty acid; this can be extracted and used in the hydrolysis of various fats.

On account of the presence of a poisonous protein—called *ricine*—the seed-cake cannot be used as fodder unless the toxic substance is removed or neutralized. This end can be most readily achieved by coagulating the protein by means of steam or by means of a 10 per cent salt solution. The use of the seed-cake as fodder has not, however, become very extensive. The material is for the most part used as fertilizer.

In India the oil is used in the treatment of soft leather, as for thongs; and the extracted seeds, still containing a considerable amount of the oil, are used not only as a fertilizer, but also for dressing sole-leather, for treating wood to be used in construction, and as a fuel.

## Wireless Stations Run by Windmills

THE Dutch colony of Curaçao, which lies in the permanent trade wind belt, has three wireless stations—one with a radius of 300 miles—all of which are run chiefly by wind power. It is rare that the winds are not strong enough for the purpose, and then a gasoline outfit is used.

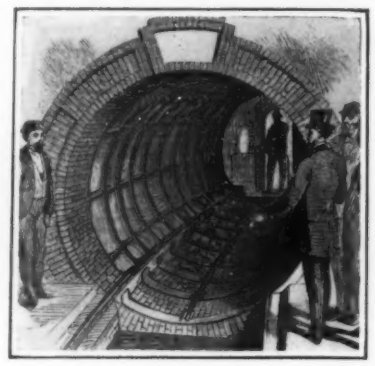
**The car.**

From the *Scientific American* of March 5th, 1870.

# New York's First Subway

## How Alfred E. Beach, Editor of the Scientific American, Secretly Built a Pneumatic Railway Beneath Broadway in 1869

By Waldemar Kaempffert



**The tunnel.**

From the *Scientific American* of March 5th, 1870.

IT took New York forty-three years to carry out an idea first proposed and experimentally executed by the SCIENTIFIC AMERICAN. Broadway will soon be tunneled for a subway, tunneled, moreover, by almost the exact methods advocated by A. E. Beach in the days when New York thought cars drawn by horses marked the limit of human ingenuity in providing quick transportation for a congested population. Section No. 2 of the new subway is soon to be dug. Part of it the engineers will find tunneled for them.

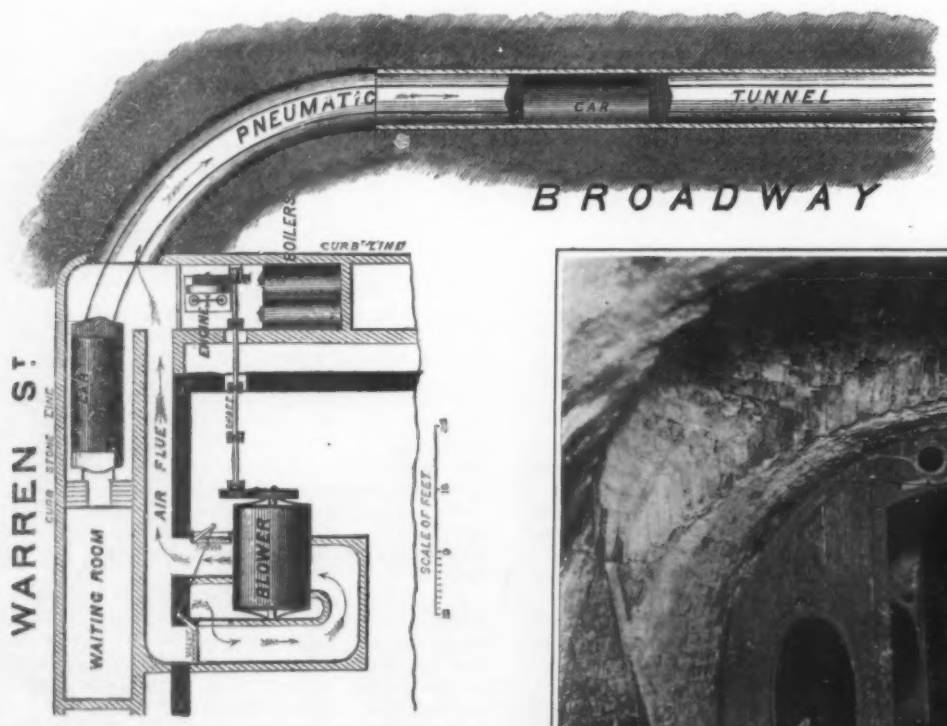
It is difficult for us to realize that small as New York was fifty years ago the transportation problem was almost as pressing as it is now. When hardly four years old the SCIENTIFIC AMERICAN fought strenuously for a rational solution of that problem. In the issue of November 3rd, 1849, appeared an editorial entitled "An Underground Railroad in Broadway," in which we read:

"The plan is to tunnel Broadway through the whole length, with openings and stairways at every corner. This subterranean passage is to be laid down with a double track, with a road for foot passengers on either side—the whole to be brilliantly lighted with gas. The cars, which are to be drawn by horses, will stop ten seconds at every corner—thus performing the trip up and down, including stoppages, in about an hour."

It is a far cry, from a horse-drawn railway and a tunnel "brilliantly lighted with gas," to a high-speed, electrically illuminated subway; but it was all that the engineering facilities of the year 1849 could offer. Crude as the system was, it was infinitely better than anything that New York, or for that matter, any civilized city in the world, could offer.

**The grating in City Hall Park, covering a ventilating opening leading to the Scientific American tunnel.**

In the picture Mr. F. C. Beach, son of A. E. Beach, is shown, holding a small model of the shield with which the tunnel was dug.




**Plan of New York's first subway, built by the editor of the *Scientific American* in 1869-1870.**

From a wood cut published in the *Scientific American*, March 5th, 1870.

Year after year the SCIENTIFIC AMERICAN, in company with the newspapers of the day, berated the city authorities for their negligence in providing adequate transportation. Finally, Mr. A. E. Beach, who, with Mr. O. D. Munn, founded the SCIENTIFIC AMERICAN, determined to attack the problem himself. He had been an earnest advocate of the pneumatic system of transmitting packages, above all, packages of letters. Experiments had shown that a carrier containing letters could be blown through a tube. If a package of letters could be blown through a tube, why not a package of human beings in a car?

The idea bore fruit. In 1867 he exhibited at the American Institute Fair, held at the old Fourteenth Street Armory, a model of a pneumatic railroad suspended from the roof of the building and running from Fourteenth to Fifteenth streets. Through a tube six feet in diameter, with walls one and one-half inches thick, composed of fifteen layers of wood glued together, a car open at the top with a piston end was drawn in and forced back by suction and pressure by a propeller fan, ten feet in diameter and twelve inches in pitch, turning at the rate of 200 revolutions per minute. All New York came to see the model railway. The car was kept in constant operation. Hundreds of people traveled in it back and forth.

After that brilliant success the Editor of the SCIENTIFIC AMERICAN came out more strongly than ever in favor of a subway for New York. Despite his success at the American Institute Fair, his proposals were received with derision by the public press. That they must have been very exciting may be gathered from the newspaper comments of the day.

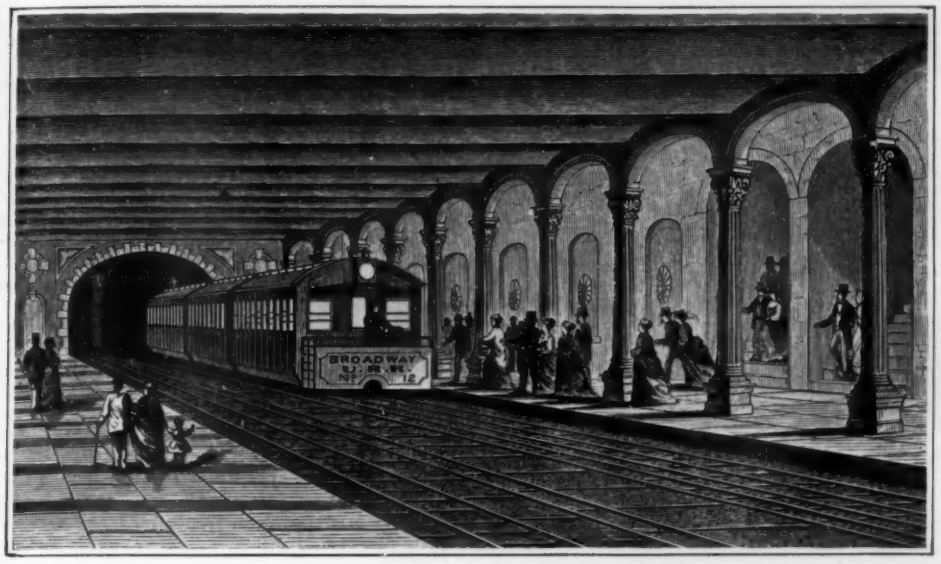
Eventually, legislative authority to build a pneumatic tube from Warren to Cedar Street was secured, and subsequently by an amended charter permission was obtained to construct one large tube for holding a group of small tubes for the pneumatic transmission of parcels and the like. Under the management of the Beach Pneumatic Transit Co., and under the supervision of Croton Aqueduct Commissioner Gen. George S. Greene, the work was begun in a quiet way and the tunnel bored by means of an hydraulically propelled shield around a curve from the southwest corner of Warren Street south down Broadway to a point nearly opposite the south side of Murray Street. The dirt was carried to the cellar of the structure at 260 Broadway, the sub-basement and basement of which had been

**The Murray Street end of New York's first subway, built in 1869-1870 by the editor of the *Scientific American*.**

The picture shows the ruins of the old car. The opening at the top is the beginning of a bricked ventilating conduit passing from Murray Street and terminating in the grated opening shown above.

rented for the purpose at Murray Street. The wall of a supposed old Dutch fort was encountered. To penetrate it, the stones had to be removed so as to leave an arched way for the shield. There was some doubt whether the street would not cave in. Editor Beach took the chance, however. One day a New York

The manner of constructing the subway is of historical interest, because it is a complete anticipation of modern methods. Mr. Beach invented an hydraulically propelled shield, for his purpose. The shield was designed in 1865, tried in 1868 and patented in 1869. It consisted of a strong cylinder very much like a huge




**This is a design for a subway station, by Alfred E. Beach, editor of the *Scientific American*, published by him in the *Science Record* for 1874, an annual compendium of scientific progress and discovery, of which he was the editor.**

*Tribune* reporter, disguised as a workman, gained access to the subway. On the following day his paper published a description of the work which created considerable interest. Not long after this publication the tunnel was completed as far as it was intended to go at that time, and was thrown open for the inspection of the public. An admission fee of 25 cents was charged. The proceeds were given to charity.

To counteract the *Tribune's* attacks and to prove to the public that it was not utterly impracticable, Mr. Beach decided to throw the subway open to the public and to permit a general inspection of the tunnel, with its car and the big machine that blew the car from one end of the tunnel to the other.

What New Yorkers saw is thus described in the SCIENTIFIC AMERICAN of February 19, 1870:

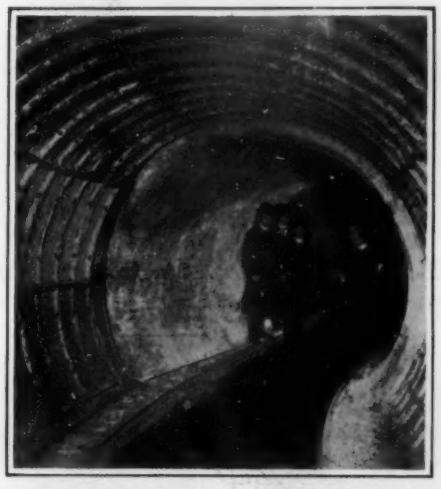
"Let the reader imagine a cylindrical tube, 8 feet in the clear, bricked up and whitewashed, neat, clean, dry and quiet. Along the bottom of this tube is laid a railroad track, and on this track runs a spacious car, richly upholstered, well lighted, and with plenty of space for exit. The whole arrangement is as comfortable and cozy as the front basement dining room of a first-class city residence. The tunnel has not only the positive comforts described, but is absolutely free from the discomforts of surface car traveling. The track is single and level; it is not cold in winter. It will be delightfully cool in summer. . . . The air will be constantly changed in it by the action of a blowing machine. The filthy, health-destroying, patience-trying street dust of which uptown residents get not only their fill, but more than their fill, so that it runs over and collects on their hair, their beards and eyebrows, and floats in their dress like the vapor on a frosty morning, will never be found in the tunnel."

For two months and more streams of people walked through the tunnel, twenty-one feet below Broadway. The tunnel itself was "brilliantly illuminated by gas," as the SCIENTIFIC AMERICAN dreamed twenty years before.

Later the blowing machinery and the car were installed. All the big men in New York came to ride on the new railway, among them Horace Greeley, its one-time opponent.

At the Warren Street end stood the car. It fitted the tunnel like a carrier of a pneumatic tube, which it really was. Eighteen persons at a time took their seats in the car, were blown from one end of the tunnel to the other by compressed air from a 100-horse-power plant, and were sucked back when the valves in the blowing apparatus were reversed.

For a year the car traveled back and forth beneath Broadway. Day after day its waiting room, forty-six feet by twenty feet, held people waiting their turn to take a ride. The newspapers which had attacked the system advocated by the SCIENTIFIC AMERICAN now applauded it. When Mr. Beach tried to have a bill passed through the legislature authorizing him to complete his scheme, he found himself face to face with a Tammany measure. His bill was passed. So was the Tammany bill, authorizing the construction of an elevated railroad at a cost of $5,000,000 to be paid out of the city treasury. A Tammany governor vetoed the Beach measure and signed the Tammany bill. The very newspapers which had attacked the subway most bitterly now raged most furiously. There was nothing for it but to close the tunnel that had actually been built single-handed by the Editor of the SCIENTIFIC AMERICAN at a cost of over $350,000.



**Where the tunnel curved from Warren Street into Broadway, bricks were used instead of iron segmental plates.**

The iron construction is almost identical with that followed to-day in subway construction.

barrel in appearance, with both heads removed. Staves were clamped endwise between two cast iron rings, the front ring being tapered to a cutting edge. A series of hydraulic rams, all operated from a common pump, were arranged along the main walls of the cylinder. By means of these rams the shield was pushed forward for a distance equal to the length of the pistons. Each ram could be cut off from the pump independently. Hence it was possible to give the shield any desired tilt, up or down or from side to side. As the work advanced the laborers dug out and carried the earth back through the shield. The rear end of the cylinder, called the "hood," within which the iron or masonry tunnel was built, was partly drawn off from and ahead of the constructed tunnel. The pistons of the hydraulic rams were then shoved back into their cylinders and a new section of tunnel was built up within the hood.

The length of the tunnel which was thus excavated beneath Broadway was about 400 feet. The exterior diameter was nine feet four inches. Starting at the head of Warren Street the tube curved down Broadway on a radius of about fifty feet. The curved portion was walled with cast iron plates, put up in segments and united by screw bolts, very much in the modern way. The straight portion was walled with brick masonry.

Why, it may be asked, why did not New York carry out the Beach project after the conspicuous success of the experimental section? It seems ridiculous now to learn that the chief objection was the fear that buildings would topple. In 1869 Trinity Church was the tallest structure in New York. Surely, thought the engineers of the day, surely the foundation of that enormous spire would crumble if Broadway is burrowed. Since then skyscrapers have been erected along the main thoroughfare of New York, and yet the subway that runs beneath them does not affect their stability.

Long after the tunnel between Warren and Murray streets was closed, the SCIENTIFIC AMERICAN fought for the subway iden. Mr. Beach planned a road beginning at the Battery and extending under Broadway to Central Park. A short lateral branch, east from 42nd Street, was to form a connection with the tracks of the Harlem Railway at the Grand Central Depot. The total distance was to be about five miles, and the estimated cost was $10,000,000.

## Seismology in Russia

THE seismological service of Russia has been reorganized and placed upon a most satisfactory basis, owing to the liberal funds voted for this purpose last year by the national legislature. An annual allowance of $24,000 has been granted, and, in addition, a special fund of $37,500 for the purchase of new apparatus and for the erection of a central station, with dwelling-house, laboratories, etc., at Pulkova. The work of this service throughout the empire is carried on under the Central Seismological Commission, which is attached to the Imperial Academy of Sciences at St. Petersburg, and is, like the Academy itself, an official organization. Its president is Prof. Backlund, director of the Pulkova Observatory. When the reorganization is complete Russia will possess seven seismological stations of the first order, and eighteen of the second order, besides the central observatory at Pulkova. The service is carrying on, besides the ordinary routine of recording earthquakes, many special investigations of great practical interest; thus the station at Makejevka is studying the connection between seismic disturbances and the liberation of fire-damp; that at Baku—in the heart of a world-renowned petroleum district—is paying special attention to the effects of earth tremors on the flow of the petroleum wells, etc.

**An improved Beach hydraulic shield as used in building the tunnel under the St. Clair River.**

This was patterned after the smaller and cruder shield used by Mr. Beach in building New York's first subway. (From a wood cut published in the *Scientific American* January 25th, 1896.)

# Recent Happenings in Aviation

## A New Control for Aeroplanes—A Fatal Accident With a Parachute

### The Boland Biplane

**By Stanley Yale Beach**

FOR several months past Frank Boland, a founder of the Aeronautical Society and one of the pioneers in aviation in America, has been flying at Mineola, L. I., in his latest biplane—a machine that, as our illustrations show, is both novel and an excellent flyer.

Besides being a tailless machine, the Boland biplane is of particular interest, because it has no ailerons, warpable wings, nor vertical rudder—in other words none of the parts included in the Wright patent with which, it was feared, the two famous brothers might attempt to dominate aviation the world over.

While the Wright biplane, which was originally tailless, has been modified and the horizontal rudder has been removed to the rear, Mr. Boland prefers to retain the elevator in front, and to make it of generous size. The dimensions of the horizontal rudder on his machine are 3 by 12 feet, and the front edge is 13 feet in advance of the front edge of the main planes. With 36 square feet of lifting surface so far in front, the elevator can be made to produce a powerful and quick lift when circumstances require it. On one occasion Boland jumped a fence with his machine when onlookers thought he would surely crash into it. The death of Eugene Ely, it will be remembered, was caused by the failure of his "headless" biplane to respond quickly enough to the upward movement of the rear elevator when he was making a spectacular dive.

Thus the advantage of a large horizontal rudder in front is obvious. In his very latest machine Boland has terminated the upward-curved skids about on a level with the lower plane, and has located the elevator at this point. Besides giving the aviator an unobstructed view ahead, this placing of the elevator causes it to act as a buffer and to prevent the machine from over-turning if it strikes the ground at an angle or lands in a bad place.

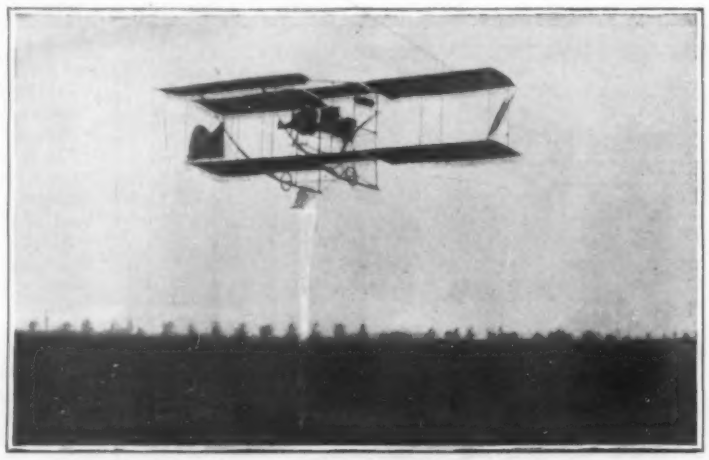
The most interesting feature of the Boland biplane is the hinged vertical flaps that steer the machine and serve to maintain the transverse stability. There is one of these flaps at each end of the machine. The lower main part of each flap is triangular in shape, while there is an extension above that makes the flap approximately a rectangle. Considering the lower part of each flap as a right-angled triangle, the flap turns on the hypotenuse of said triangle as a pivot, its rear bottom corner being pulled inward toward the center of the machine by a wire running to the control wheel. The upper part of the flap of course moves out in the position shown in one of the illustrations in which the photographer happily caught the aeroplane in flight at the moment the control wheel was being sharply turned.

The effect of moving the flap as shown in this picture is to turn the machine to the left and to slow down the left end. The resistance set up by the flap makes it possible to turn very sharply and at an exceedingly steep inclination; but even more remarkable is the fact that the machine climbs in turning instead of dropping as most aeroplanes do. The transverse equilibrium is maintained by slowing down the high side by means of the flap, and thus causing it to drop. Steering is accomplished by turning the wheel the same way that an automobile steering wheel is turned, while side-tipping is corrected by turning down on the side of the wheel toward the high side of the machine. Fore-and-aft movement of the wheel works the front horizontal rudder.

The inventor himself has flown his biplane in puffy winds of as high as 40 miles per hour velocity, and has experienced no difficulty in controlling it. According to Capt. T. A. Baldwin, he flies easily in winds that most other biplanes navigate with difficulty. He has, therefore, thoroughly demonstrated the practicability of his novel method of control.

The main planes of the Boland biplane are 5½ by 27½ feet in size, spaced 5½ feet apart. The overall length fore-and-aft is but 18½ feet. The large, heavy skids are 5½ feet apart. The lower plane is but 30 inches above the ground. The weight of the machine complete is but 800 pounds. The motor used is an 8-cylinder, V-type, Boland motor, having 4 by 4-inch cylinders and carrying on its crankshaft a 7½-foot diameter, 6-foot pitch propeller. The engine makes 1,200 revolutions per minute in flight, and the propeller gives a standing thrust of 385 pounds.

This new tailless biplane is the result of seven years of experiment in the course of which its inventor has built and flown many machines. The first experiments with the hinged flaps were made five years ago with a monoplane, upon which they operated successfully. During the course of his experiments Mr. Boland has had many narrow escapes, but he has come out thus far unscathed, and we hope he will continue to do so.



**Front view of Boland biplane in flight, showing (at right end) vertical control flap inclined in order to turn machine.**

**Rear view of Boland biplane while making a moonlight flight.**

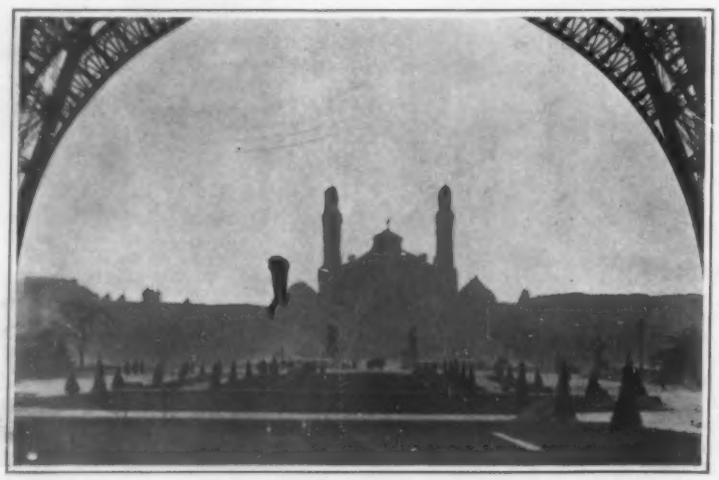
### A Fatal Parachute Experiment

IN the SCIENTIFIC AMERICAN of November 6th, 1910, we published an illustrated description of an aviator's garment, so designed that it would belly out and constitute a parachute after falling a few feet. So convinced was the inventor, Franz Reichelt, an Austrian resident of Paris, of the merits of his garment that he determined to test it by jumping from the Eiffel tower. On February 5th, he donned his curious garment and proceeded to carry out his experiment. He leaped from the first platform of the tower. The parachute failed to work and Reichelt was dashed to death.

Reichelt's garment was provided with an enormous hood of silk gathered together on the back so that it resembled a knapsack in appearance. The hood was to be released by the wearer of the garment himself. Reichelt had made experiments with his garment in the courtyard of his house. A mannikin had been used. The preliminary trials were for the most part unsatisfactory, according to accounts which we have received from Paris. It seems incredible that any man should venture on such a hazardous attempt and repeat it on so large a scale after failure.

**Reichelt wearing the parachute garment in which he was killed.**

**Picking up fragments of Reichelt's parachute garment.**



**Reichelt on his fatal plunge.**

The photographer who took this picture thought that a dummy was in the parachute. No one believed that a man was falling to death.

### The Latest Monoplane Speed Records

THE speed records made by Vedrines on a 100-horse-power Deperdussin monoplane, and mentioned in our last issue, were beaten on January 27th by Bathiat on a Sommer monoplane fitted with a 70-horse-power Gnome motor and a Chauvière propeller. The latest records were made over a circular course at Douzy, and although sufficient fuel and oil for three hours' flight were carried, Bathiat was obliged to descend after remaining 49 minutes in the air. The new records are as follows: Ten kilometers, 4:8 1/5; 20 kilometers, 8:13 1/5; 30 kilometers, 12:25 1/5; 40 kilometers, 16; 33 1/5; 50 kilometers, 20:43 1/5; 100 kilometers, 41:29 3/5. At one part of the flight he made a speed of 150 kilometers per hour (93.2 miles per hour), and his average speed for 20 kilometers was 146.044 kilometers per hour (90¾ miles per hour), which is better than Vedrines' best speed over a single lap of 145.177 kilometers per hour, although the Sommer monoplane had 39 horse-power less.

# The Laboratory

## Some Suggestions for Home Experiment

### Some Simple Catalytic Experiments

By Philip Edelman

THE following are but a few of the countless experiments which may be performed in catalysis, and will be found within the means of the home experimenter.

There are certain substances called catalysts which, although they may appear inert in a container, have the power, without themselves undergoing any permanent change, to regulate the actions which may take place in it. For this and other reasons catalysts are very interesting. Like a general controlling a large army, a small portion of a catalyst can control the chemical changes of large quantities of substances.

1. Put a few violet chromic chloride crystals into a test tube half filled with water. The crystals being insoluble will not dissolve, even if left in the water for some time. Now introduce a catalyst into the tube in the form of a minute particle of chromous chloride, and the violet crystals at once dissolve, forming a dark blue solution. The particle of the chromous chloride used is exceedingly small (0.00003 of one gramme being sufficient) yet it makes the insoluble crystals at once soluble. This illustrates physical catalysis, the chromic chloride merely passing into solution.

2. Put a few small pieces of tin into a test tube half filled with hydrochloric acid. There should be no action apparent. Now put a drop of a solution of platinum (see experiments under 3, for the preparation) into the tube, and the catalyst, in the form of platinum this time, at once causes the acid and tin to interact vigorously. The merest trace of platinum controls this action. This experiment illustrates chemical catalysis.

Catalytic substances are ever working throughout all animal and vegetable life. Common yeast is a good example of an organic catalyst, a small quantity being able to change a large amount of sugar into alcohol.

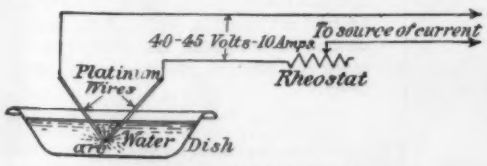
This brings us to the catalytic agents known as colloids. Colloidal suspensions remain distributed in liquids like true solutions without settling to the bottom of the container. They consist of very finely divided particles mechanically suspended in the liquid, from which they cannot be separated by filtering.

3. Metallic colloids can be prepared as follows: Into a clean evaporating dish or similar container put some distilled water. For colloidal platinum some pieces of wire or scrap will do. Fasten these platinum wires to the terminals of a battery or generator, as shown in the cut. Adjust the rheostat so that a flow of ten amperes at forty or forty-five volts is available at the terminals. Dip the platinum terminals into the pure water with your hands. Now bring the wires very near to each other, so that an arc forms beneath the surface of the liquid. You may have a little difficulty in starting the arc, but after the platinum points get heated, the arc can be intermittently maintained. Little clouds emerge into the liquid at each flash until the liquid becomes colored with the finely divided platinum particles. The preparation is complete when the liquid becomes a dark brown-black shade, and should not be continued further.

For gold, the colloidal gold is prepared in a similar manner. Pieces of gold from old spectacles, etc., are suitable and should be preferably 14-carat or more. The gold gives a pleasing ruby-colored solution.

Silver, aluminium, copper, and other metals can be treated in the same way. In each case finely divided particles of the metal are emitted into the water from the arc and held suspended in it. The resulting liquids in each case are not true solutions, but are colloidal suspensions.

4. Peroxide of hydrogen is a compound of water and oxygen. This compound is unstable and gradually de-




**Preparation of colloidal platinum.**

composes. The decomposition is very suddenly accelerated by the addition of a minute drop of the colloidal platinum. In this respect the colloidal platinum acts very much like a drop of blood. You can try this with a drop of your own blood. The resulting effervescence is caused by the catalyst called "hæmase," which is a colloidal suspension in the blood.

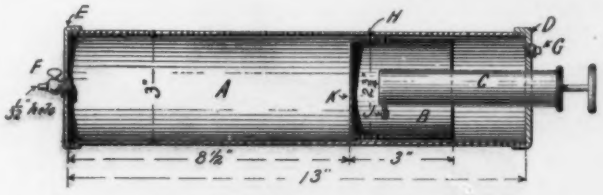
5. Vary experiments under 4 by increasing the temperature, by cooling, etc., using both the blood and the colloidal platinum. Certain substances commonly called poisons have the property of retarding or stopping the action of colloids.

6. Pour a few drops of mercury into a clean test tube and pour a little of the peroxide (diluted) over it. The mercury is the catalyst in this experiment, and it causes the peroxide to decompose by its presence. But this is not all. The decomposition occurs intermittently. First a brown film gathers on the surface of the mercury. Then the oxygen is liberated. This action is repeated periodically.

### Home-made Chemical Fire Extinguisher

By W. J. C.

THE fire extinguisher made from the following directions will be found to be not only remarkably efficient in preventing the spread of a fire, but simple of construction and inexpensive. The material required




**Details of the home-made fire extinguisher.**

is a piece of 3-inch O. D. brass tubing 13 inches long, *A*; a piece of 2¾-inch O. D. tubing about three inches long, *B*; a piece of brass about one-thirty-second inch thick, and 2 11/16 inches in diameter, *K*; two 3-inch caps, *E* and *D*, to fit 3-inch tubing; a ⅛-inch pet cock, *F*; a ⅛-inch plug, *G*; an old bicycle pump, *C*, and a valve, *J*, similar to an inlet valve on a tire.

The brass plate or disk *K* is soldered into *B* to form a bottom, and the whole is wrapped with lamp wick so as to form a tight fit in the larger tube. The cap *E* is tapped for a ⅛-inch pet cock *F*, the opening in which should not be over one-thirty-second inch; the cap is then screwed or soldered on the tube *A*. The other cap *D* has the bicycle pump soldered into the center, extending about four inches beyond the cap. A plug *G* is also tapped into cap *D*. The small tire valve is soldered to the pump at *J*, so as to act as a non-return valve. The cap carrying the pump is screwed or soldered to the tube *A*, and the apparatus is complete. In order to fill the machine, proceed as follows: Remove the plug *G*, which acts as a vent. Remove the pet cock *F*, and with a stick push the sliding tube *B* to about 8½ inches from the opening. Now replace the plug *G*, and with a funnel fill the front part of *A* with the extinguishing chemical, after which replace *F* and close the pet cock. Now pump up a pressure in the end of tube *A* until the pump works hard and the machine is ready for use.

If all joints have been made tight the extinguisher will hold its pressure indefinitely, and will always be ready for instant use. It should be kept in a vertical position, the pump being on top.

When occasion arises to use it, all that is necessary is to open the pet cock *F*, when a stream of the extinguishing fluid will issue with pressure enough to carry a distance of 30 feet. As there is no pumping to be done, the device may be held steady and aimed accurately. The entire thing can be held in one hand, allowing the use of the other to pull down curtains and remove obstructions. The best solution for this extinguisher is tetrachloride.

### Maintaining a Constant Level in Batteries

By William D. Munger

THE difficulty of maintaining a constant level of electrolyte in the wet type batteries, especially storage batteries, may be obviated in a very simple manner.

Secure a bottle with a large long neck, fill with water, hold your finger or a piece of iron shaped like a hoe over the mouth, and invert, placing the mouth well under the top of the electrolyte in the battery. Now withdraw the bottle so that the mouth is 1/16 inch or so above the desired level of the electrolyte, and fasten the bottle in that position.

When the level of the electrolyte is reduced by evaporation, 1/16 inch or so, air will be let into the bottle and water will run into the battery till the level is restored.

### A New Method for the Determination of Sulphur in Pyrites and Pyrrhotite

By L. Shumacher

BY common consent Prof. Lunge's method for the determination of sulphur in pyrites and pyrrhotite is considered the best. While it gives the most exact results, it is also the most tedious of all methods.

Lunge states that the silica must be filtered out and washed, and also the iron precipitate, before separating the sulphur. This operation requires a very long time.

In his experience extending over a number of years, the author has found that by the method described below the results, equalling those of the standard method, can be obtained in one-third the time. The washing of the silica and iron precipitate can be dispensed with completely, and at the same time the danger of cracking the filter during the hot lixiviation is avoided. In acid factories, at mines, and in other places where analyses have to be performed daily, a great saving of time will be effected by the use of the shortened method.

Place one-half gramme of finely powdered pyrites in a porcelain casserole and add 10 cubic centimeters of aqua regia (three-quarters nitric acid and one-quarter hydrochloric acid). Allow to stand for about fifteen minutes in a warm place, evaporate to dryness, add six cubic centimeters of concentrated hydrochloric acid, and evaporate again. When the residue is cold add 90 to 100 cubic centimeters of hot five per cent hydrochloric acid solution, and let the liquid stand until it is dark green. Then pour into a 250 cubic centimeter flask, wash off the funnel, and precipitate the iron with 6 cubic centimeters of ammonia. Make up the solution in the flask to 250 cubic centimeters with water, and mix well by shaking. Filter off 100 cubic centimeters and place it in a beaker. Add 2 cubic centimeters of concentrated hydrochloric acid, boil and precipitate with 10 cubic centimeters of hot ten per cent solution of barium chloride. Filter, dry, ignite, and weigh.

Factor and Multiples for Computation.

| | | | |
|---|---|---|---|
| 1 | 0.0687 | 6 | 0.4122 |
| 2 | 0.1374 | 7 | 0.4809 |
| 3 | 0.2061 | 8 | 0.5496 |
| 4 | 0.2748 | 9 | 0.6183 |
| 5 | 0.3435 | | |

Example:

| | |
|---|---|
| Found 247 grammes barium sulphate | 13.74 |
| | 2.748 |
| | 0.4089 |
| Sulphur | 16.8969 |

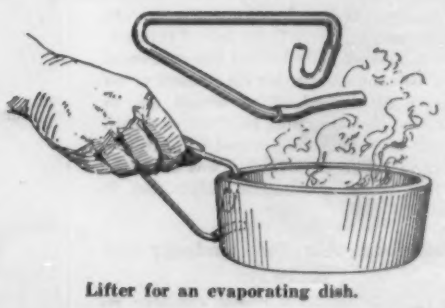
By this method one man can easily make fifty analyses in a day, and these, if carefully made, agree with the results obtained by Prof. Lunge's method.

It may be added that there is no need of adding one or two drops of nitric acid in the ignition. This precaution, which is often recommended, does not bring any advantage.

### Simple Lifter for the Laboratory

By George A. James

A VERY convenient little device for the home laboratory is illustrated herewith. It consists of a detachable handle for lifting receptacles such as evaporating dishes and the like. The lifter is made of a heavy piece of wire bent to the shape indicated in the drawing. One end is curved to fit against the outside of the



**Lifter for an evaporating dish.**

dish, while the other end fits over the rim inside. The parts that come in contact with the dish are rubber covered, two short pieces of rubber tubing being slipped over the wire. The device is so useful, and can be made so quickly and cheaply, that it should find a place in every amateur's laboratory.

# What Inventors Are Doing

## Simple Patent Law; Patent Office News; Inventions New and Interesting

### Some Curious European Motor Sleighs

THE adaptation of the automobile for use in snow is receiving much attention in Europe. Each year brings forth its own curious examples of inventive ingenuity in this line. Some of the more interesting developments of the present year are shown in the accompanying illustrations.

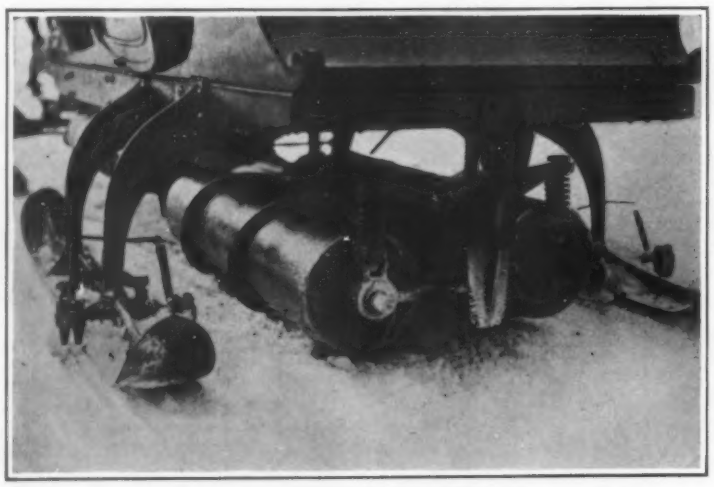
In Steinhaus, Austria, a motor sleigh may now be seen which differs from the ordinary in the peculiar steering devices employed. The body of the sleigh is an automobile. It is supported mainly on a pair of large runners over fifteen feet long. In advance of these long sleigh runners are two rudder shoes (if we may call them such) which are connected to the steering post of the automobile, and hence may be steered just as if they were automobile wheels. In some previous motor sleighs the rear runners were used for steering purposes and the motor drive was placed in front. This was open to the objection that when traveling on ice there was much difficulty in turning a corner. The sleigh is driven by a large toothed-wheel that is turned by a motor of from 14 to 16 horsepower. As in Europe every motor vehicle is subsidized by the government, the present vehicle has received official attention and is considered a favorable type for the carriage of freight in time of war.

Another type of motor sleigh which is shown in two of our illustrations, employs a very unique form of propulsion. The body of the sleigh, which is an automobile of the standard design, is supported on runners fore and aft, the forward runners being movable to steer the vehicle. Between the rear runners are a pair of cylinders formed with helical flanges of opposite pitch. These two worms are revolved in opposite directions by the motor to which they are geared by a two-to-one gear. As they revolve the worm thread digs into the snow and drives the vehicle forward. The worms are pressed into the snow by means of a pair of springs, as shown in one of our illustrations. These springs serve to take up any inequality in the roadway and also compensate for variations in the hardness of the material over which the vehicle is traveling. To allow for the flexible mounting of the worms they are connected by means of Cardan joints to the motor. The brake of this vehicle consists of a pair of forked levers which span each of the rear runners and are provided with spikes adapted to dig into the snow when the levers are operated by the brake pedal. A speed of 50 kilometers or 31 miles per hour has been obtained by this curious motor sleigh.

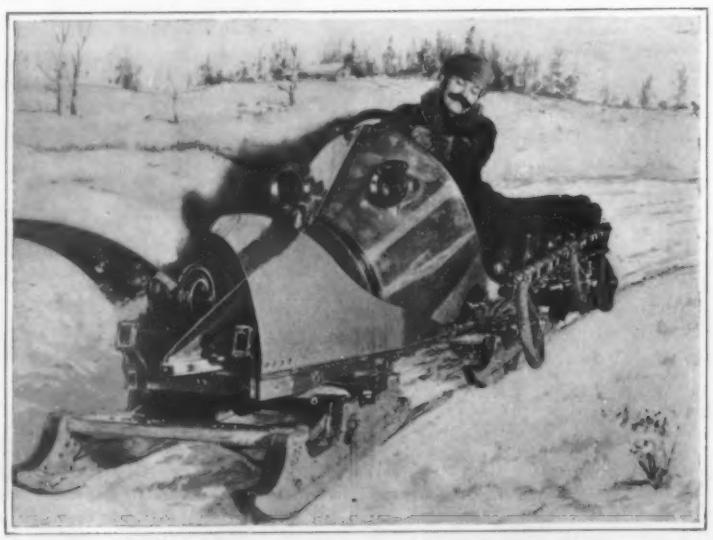
Our fourth illustration does not properly belong with the other vehicles described, as it is not motor driven. It is a coasting sled adapted for the use of a large number of passengers. However, we have included it in this list as it employs some features common to the automobile. The steering for instance, is done by means of a steering wheel controlling the front pair of runners. The six-seated body behind the steersman may be supported either on runners or on wheels, as desired. The wheels are so mounted that they may be lifted, as shown in our engraving, or lowered to operative position. This curious sled was exhibited at the recent Aeronautic Exposition in Paris.

Austrian motor sleigh with novel steering shoes.

French motor sleigh with unique worm drive.



The worms that propel the motor sleigh.



A coaster that runs on wheels or runners.

SOME CURIOUS EUROPEAN MOTOR SLEIGHS

### Ozonized Air for Underground Railways

ACCORDING to a recent consular report, a novel system of ventilation is about to be installed in the "tubes" (i. e., deep-level underground railways) of the Central London Railway Company. The problem of providing pure air to underground railways has been found a troublesome one all over the world, and has sometimes been pronounced insoluble. The difficulty seems to be not so much with the quantity as with the quality of the air supplied according to the present methods. This difficulty is to be met by dosing the air with ozone.

It is proposed to install a ventilating plant at each station. The air will be drawn from the outside through a filter screen, which removes dust and dirt and impure gases. A part will then be highly ozonized by being passed over electrified plates, the proportion of ozone to the whole of the final mixture being one part in 10,000,000. The air will be driven by fans to the level of the bottom of the station, and two-thirds of it will be distributed over the platform by ducts with outlets at a height of 7 feet above the platform. The remainder will be driven into the tunnel.

It is stated that each plant will pump 400,000 cubic feet of air per hour into a station, which is equivalent to 900 cubic feet per person per hour, or three times as much as is usually considered necessary in ventilating buildings.

### Notes for Inventors

**Two Hulett Loading Patents.**—George H. Hulett of Cleveland has obtained two patents, Nos. 1,010,766 and 1,010,767, one for loading machinery, and the other for loading and trimming mechanism for boats. The first patent shows a traveling tower and chute, together with hooked bars and a dump car operated thereby to discharge into the chute, while the other has a tower and chute and a tilting housing which has means for lengthening and shortening the chute.

**Repairs Fractures in Cigars.**—Leonard Rodenbausen of Philadelphia in patent No. 1,008,730 provides a material for closing perforations and fractures in cigars. It is in the form of a liquid preparation composed of a solution of tobacco as a base and a quick-drying adhesive substance including sugar, water and alcohol which may be applied to close the fractures and perforations in the wrapper of the cigar.

### Legal Notes

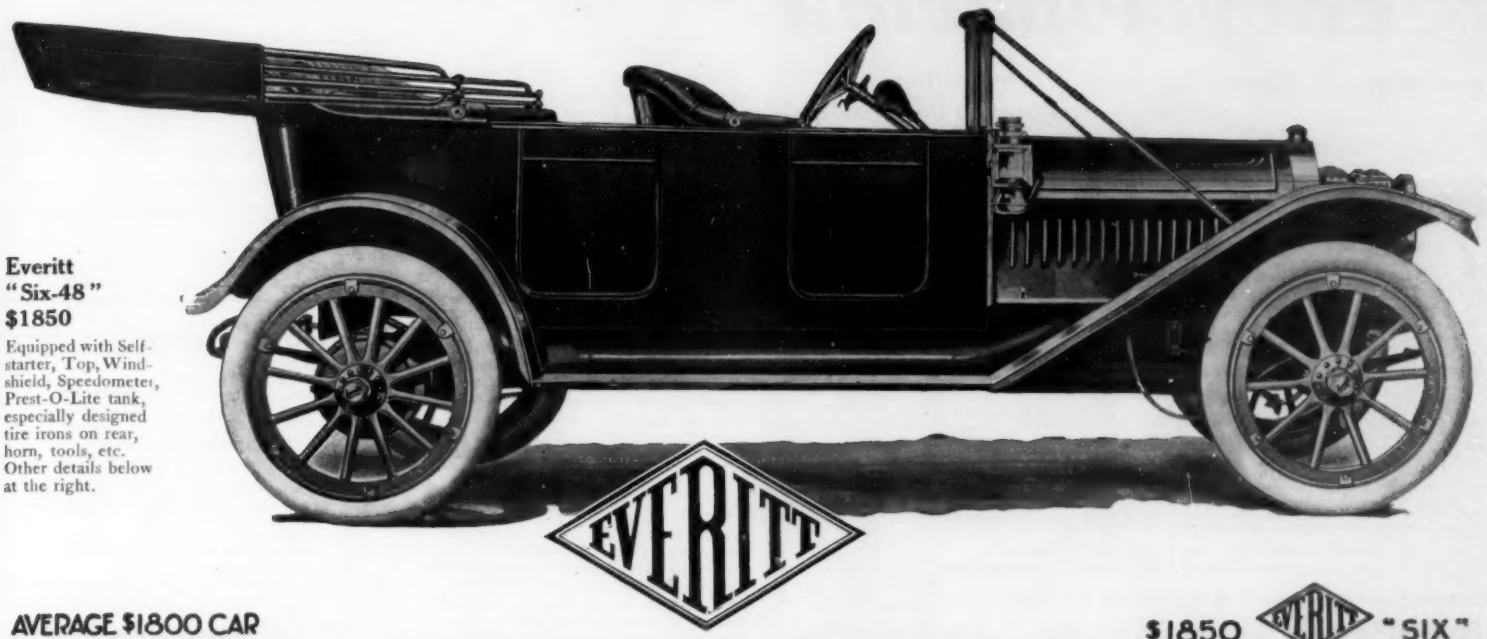
**A Patent Decision that Affects 50,000 Dentists.**—On December 3rd, 1907, Wm. H. Taggart, of Chicago, Ill., was granted patent No. 872,978, for a Method of Making Molds for Dental Inlays and the like. An action was brought against George W. Boynton by Taggart, to prevent further alleged infringement. In defense it was set up that the method disclosed in the patent was old. The court found that the process described in the patent had not been used more than two years prior to January 12th, 1907, and that the defense had not established satisfactorily such public use as would invalidate the patent. Consequently, the patent was sustained and an injunction was issued.

Chief Justice Clabaugh, before whom the case was heard in the Supreme Court of the District of Columbia, criticised the present method of burdening the court with an enormous amount of unnecessary testimony.

"Counsel have been most elaborate in setting out their ideas of the testimony of the case; in other words, have made the briefs almost as long and voluminous as the testimony and made a record, to say the least, unnecessarily large. I do not know why these matters, when it comes to patent cases, cannot be made less burdensome in the way of records. Whatever the reason, this character of case always necessitates a good deal of work on the part of the court and I have given it a good deal of consideration and listened most attentively to the arguments as to what the finding would be so far as the facts were concerned."

The law was so manifest that the Court did not find it necessary to cite authorities.

# Pictures that draw a parallel of tremendous importance




**Everitt "Six-48" $1850**

Equipped with Self-starter, Top, Windshield, Speedometer, Prest-O-Lite tank, especially designed tire irons on rear, horn, tools, etc. Other details below at the right.

AVERAGE $1800 CAR

NUMBER OF CYLINDERS 1 2 3 4

WHEELBASE

112 TO 118 INCHES

SIZE OF WHEELS

34 INCHES

SIZE OF TIRES

DEMOUNTABLE RIMS – NO

SELF-STARTER – NO

CONSTRUCTION

OPEN HEARTH STEEL

Quite properly, a motor car manufacturer is not permitted, in an advertisement, to point out those features in which his car excels other cars—and mention those cars by name.

But there are some Everitt truths so big and overshadowing that they cannot be held down.

For instance, that there is no other *six-cylinder* car in the market—of equal wheelbase, horsepower, equipment, and proportion of chrome nickel construction—at $1850 or anything like that price.

If it is a four-cylinder car you picture in your mind—selling from $1800 to $3500—in all likelihood it will fall hopelessly behind the Everitt "Six-48" in horsepower, wheelbase, and the proportion of high caliber steel used in the construction. It probably will not equal the Everitt in complete equipment, a self-starter, or demountable rims.

If it is a six-cylinder car, and includes some—or even all—of the extraordinary Everitt features, you will find the price twice or thrice the Everitt price.

The deliberate purpose of this announcement is to induce you, by pictures and by arguments, to make a deadly parallel in your own mind between what $1850 buys you in the great big beautiful Everitt "Six", and

First, what $1850 or more buys in the four-cylinder field; and

Second, what the splendid Everitt features of value cost in the six-cylinder field.

If you make such a comparison, you're *bouna* to seek an Everitt demonstration—and that inevitably means Everitt ownership.

## METZGER MOTOR CAR CO. 116 Milwaukee Avenue East Detroit, Michigan

**Everitt "Four-36"—$1500**

Construction throughout of the same high type as the "Six-48." Wheelbase, 115 inches; Tires, 34x4 inches; Demountable Rims. Equipment complete, including Top, Windshield, Speedometer, Prest-O-Lite tank, specially designed tire irons, unusually high-grade tool equipment, and Self-Starter.

**Standard "Everitt 30"—$1250**

Wheelbase, 110 inches; Tires, 34x3½ inches; Quick Detachable Rims; Equipment complete, including Silk Mohair Top, Windshield, Two Gas Lamps, Three Oil Lamps, Generator, Horn, Tools and Repair Kit.

**USE THIS COUPON**

**Metzger Motor Car Co.**
**116 Milwaukee Ave. East**
**Detroit, Michigan**

**Send 1912 Catalog and dealer's name.**

.....

.....

.....

$1850 EVERITT "SIX"

NUMBER OF CYLINDERS 1 2 3 4 5 6

WHEELBASE

127 INCHES

SIZE OF WHEELS

34 INCHES

SIZE OF TIRES

DEMOUNTABLE RIMS – YES

SELF-STARTER – YES

CONSTRUCTION

ALL NICKEL CHROME STEEL

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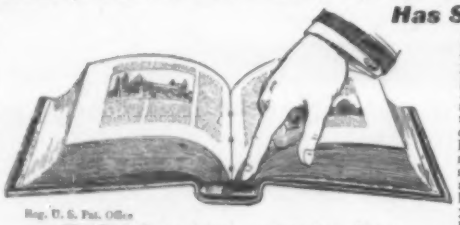

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## RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

### Electrical Devices.

SPARK INDICATOR.—L. E. TAIT, care of Red Cloud Auto Company, Red Cloud, Neb. This invention refers to a device adapted to form part of an electric circuit, and more particularly relates to the means used in conjunction with a spark plug whereby a spark gap may be formed in the secondary circuit of the induction coil in order to determine the presence of electricity in the circuit.

THERMOSTATIC ALARM SYSTEM.—W. G. ASMUS, care of Electric Railway and Lighting Company, 208 Electric Building, Cleveland, Ohio. This invention comprehends a thermostatic alarm system in which a part of the wiring is fixed and is connected with electrically-operated alarm mechanism, and other portions of wiring, together with thermostatic circuit closers, are mounted upon separate cars temporarily in communication with the fixed wiring by aid of the trolley poles carried by the respective cars.

THERMOSTATIC CIRCUIT CLOSER.—W. G. ASMUS, care of Electric Railway and Lighting Company, 208 Electric Building, Cleveland, Ohio. This inventor seeks to provide a thermostatic circuit closer having generally the form of a screw plug and adapted to be mounted in a receptacle or socket somewhat after the manner of an incandescent globe, the plug being provided with heat controlled contact mechanism for closing a circuit.

### Of General Interest.

RIFLE SIGHT.—D. W. KING, 2552 Albion Street, Denver, Col. An object here is to provide a sight which is constructed so that it cannot be caught on the brush or other objects while using the rifle, and which also allows the rifle to be placed in or withdrawn from a scabbard or case without catching on the latter. The sight has a head which may be easily cleaned or polished, and which will reflect more light than ordinary sights, thereby allowing it to be seen earlier and later in the day than other sights.

INDICATOR FOR STORAGE VESSELS.—O. S. KING, 218 East 42nd Street, Borough of Manhattan, New York. The purpose here is to prevent people from drinking poison and other deleterious substances, by mistake. The invention comprises a signal device attachable to either the stopper of the bottle or other storage vessel, or to the neck thereof, by means of which a person handling the same will be informed at a single glance that the contents of the vessel are not intended for internal use.

GRAPPLE.—Address J. C. B. EHRINGHAUS, Elizabeth City, N. C. This device is adapted for gripping and hauling or hoisting heavy articles, and particularly for use in logging or for hauling logs endwise to the mill or to any point where it is desired to collect them. It is composed of two sets of hook-shaped grippers or jaws so connected that tension on the rope or cable connected with one set of the jaws operates to simultaneously close the others, the greater the tension the firmer being the grip.

BRACKET FOR TURPENTINE CUPS.—J. S. SHANDS, care of Shands Turpentine Cup Company, Gainesville, Fla. This invention provides a bracket or hanger for supporting the cup, which bracket can be put up by unskilled labor, can be repeatedly bent into desired position to hold the cup on a level and which will hold the cup so that a blow or pressure outwardly on the under side of the cup will not knock it off the hanger.

FLUID TIGHT EXPANSION JOINT.—C. E. HEITMAN, New York, N. Y., assignor to H. LANGE, Central Avenue, Mohegan Heights, Yonkers, N. Y. This improvement relates to joints for connecting pipes or conduits to walls, partitions, or tube sheets, and the object of the invention is to form a very simple and efficient joint which will be perfectly fluid tight, and which will permit of a relative movement of the tube or conduit, and the wall or plate.

FIRE ESCAPE.—H. GRÜNBAUM, 144 Lewis Street, Borough of Manhattan, New York, N. Y. For the purposes of this invention, use is made of a main ladder hung on links, pivoted on brackets attached to the wall of the building, a bottom extension ladder mounted to slide on the lower end of the main ladder, and means for releasing the extension ladder on swinging the main ladder from a folded position into position for use.

CARDING DOFFER AND METHOD OF CONSTRUCTING SAME.—F. M. MOORE, Oldtown, Maine. Among the principle objects which the present invention has in view are: to provide a doffer constructed and arranged in such a manner as to avoid loosening of the doffer cloth or drum face; to provide a method of forming the carding rings after the carding drum is completely equipped with the combing surface; and to provide a simple and inexpensive doffer.

LOOSE LEAF BINDER.—C. E. MOSSICK, care of John Bauer, 4937 Lincoln Avenue, Chicago, Ill. This invention relates to a new and improved binder for securing loose leaves together in the form of a book. A further

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object is to provide a binder with an enameled back having sides secured thereto, with reinforcing angles to brace the sides and with a simple lock to secure the sections of the back together.

FISHING TOOL.—B. J. LONG and J. I. KEITH, Finley, N. D. This invention refers to a form of guide for fishing tools, more particularly adapted for use in finding the lost drill in well boring operations, or for tapping the end of lost piping. An object is to provide a tool which will encompass the lost drilling tool, and will guide the same into a receiving socket, or will guide a taper tap into the end of a lost pipe.

ADJUSTABLE CLAMPING SUPPORT FOR SPECTACLES AND THE LIKE.—E. S. WIGGINS, Paris, Tenn. Mr. Wiggins provides a support for holding frames of articles in position to be assembled, or repaired if broken, and the invention comprises details of construction by means of which the article can be held in position by movable parts so arranged as to afford every possible adjustment for the convenience of the workmen, for which there may be need, in practice.

STILT.—H. S. THOMAS, 219 Ft. Thomas Avenue, Ft. Thomas, Ky. In the present patent the invention has reference to stilts, and it has for its object the provision of one having an adjustable foot block, with means by which the adjustable foot block may be firmly held in position on the stilt staff after adjustment.

BALCONY FOR FIRE LADDERS.—T. F. DOUGHERTY, 17 East Eighty-seventh Street, New York, N. Y. This invention is used more especially for service in connection with fires, the more particular purpose being to provide a platform or balcony to be carried upon a fire truck and to be detachably connected with the upper end of a ladder for the purpose of facilitating the escape of persons from a burning building.

### Hardware and Tools.

LOCK COCK.—C. STIFT, care of H. Hackfeld Co., Ltd., Honolulu, HI. This invention relates in general to a means for locking the stop cocks of faucets, and more particularly is adapted for use in locking a gasoline pump cock to prevent surreptitiously stealing of the gasoline from garages. The main object is to provide an article which can be readily applied to the ordinary type of structure, and which will, at the same time, constitute an effective lock for preventing the turning of the valve or cock.

COMBINATION TOOL.—J. F. O'MALLEY, 143 West 127th Street, New York, N. Y. The object of the present invention is to provide a tool for use as a back saw, wrench and pliers, and arranged to permit a quick adjustment of the movable jaw, to securely lock the said jaw in the adjusted position, to quickly release the movable jaw in the adjusted position, to quickly release the jaw whenever desired, the back frame being locked in position by the adjusting means used for the movable jaw.

SIGHT SQUARE.—F. P. MEYER, 536 East Eighty-seventh Street, New York, N. Y. This sight square is for use in survey work. An object is to provide a new and novel device for use in survey work especially in the interior of a building for the finishing thereof. In surveying this kind of work it is found necessary to locate different points about the building and to take measurements in different directions from these points. The use of this invention attains this object.

### Household Utilities.

BLIND SLAT TIP.—W. O. DALY, Mobile, Ala. In this case the invention is an improvement in the slats of blinds, and has for an object to provide for a novel form of tip whereby to avoid the difficulties resulting from the use of wooden slats, which have a tendency to break, to become swollen from weather conditions, and are otherwise objectionable..

TABLE CASTER.—A. MARINELLI, Lorento, Marches, Italy. The aim of this inventor is to provide a caster for carrying flasks or other holders containing oil, vinegar, sugar, salt, olives, cheese and the like, and arranged to normally conceal the holders and to allow access to the same for removal and use of their contents whenever desired.

WATER CLOSET.—B. R. TOROSSIAN, 362 West Street, West Hoboken, N. J. The object here is to have spraying means for ablution and under control of the user and wholly independent of flushing devices. For this purpose the front and rear of the bowl are provided with spraying nozzles, connected with a valved water supply and arranged to direct sprays of water in an upwardly-inclined direction toward the middle of the top opening of the water closet bowl.

### Machines and Mechanical Devices.

AEROPLANE.—P. D. RIORDAN, Arnot, Pa. This inventor provides an emergency righting device which may be manually arranged to correct the riding position of the aeroplane in the event of tilting or falling. The invention consists in providing for aeroplanes of usual construction an auxiliary plane of relatively small area, disposed above the body of the machine and operable manually to change the relative angle of the said auxiliary plane to the main or carrying planes to present a resistance to the rush of air when falling.

AEROPLANE.—A. E. LYCAN, Tahoe, Idaho. The planes are rotated similarly to vertical

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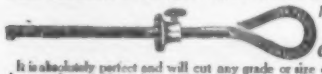

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lifting propellers whereby the machine may be lifted without a preliminary run; the propelling mechanism produces a reversing action on the machine without reversing the driving shaft; the steering mechanism embodies a propeller and rotary mechanism adapted to move the head of the machine transversely to line of flight; the balancing device permits flexibility in the frame and driving mechanism and to right the same after variation from vertical disposition thereof; and the levitating devices and driving mechanism are adapted for control by varying the effective speed thereof.

FLYING MACHINE.—E. W. F. HERRMANN, 314 Paso Hondo Street, San Antonio, Texas. This invention relates to a new and improved flying machine of the heavier-than-air or aeroplane type. The central opening and the front and rear dihedral angles go to make up a supporting plane which is automatically stable in itself, and will control the equilibrium of the flying machine to a considerable extent. The invention provides an aeroplane with a supporting plane capable of being warped at various points, so as to control the ascension and descension of the machine, and also to control the lateral equilibrium and the steering thereof.

FLYING MACHINE PROPELLER.—W. H. LAWRENCE, care of "Store," 955 Manhattan Avenue, Brooklyn, N. Y. This invention has reference to improvements in rotary fans or propellers adapted to act upon the air, and more particularly to such air propellers as are used for propelling airships or flying machines which are actuated either by hand or by a suitable mechanical device.

SCALE.—V. O. KLINGLER, Slayton, Minn. In this patent the invention has reference to scales, more particularly to beam scales, and has for an object the provision of an automatic scale for use in weighing large quantities of grain or the like, the operation of the scale being entirely automatic and self-controlled.

MACHINE FOR PRODUCING FABRIC, PAPER, OR CARDBOARD HAVING AN INCLOSURE OR CROSSING THREADS.—H. GUEFFROY, No. 11 Wormserstrasse, Berlin, Germany. Processes for producing fabric, paper, or card board have been known where they were not able to prevent tearing of the paper. This drawback the present inventor overcomes by inserting transverse threads under tension and keeping them stretched until they are tightly grasped by the pressure roll of the sticking machine and cannot get out of position. The transverse threads are caught at their free ends and pulled at a certain tension from a spool, and while retaining the tension, are introduced, parallel to one another, into apparatus designed to combine the separate widths.

VENEER LATHE.—A. W. DODGE and J. B. DODGE, Coudersport, Pa. The object of this invention is to provide a lathe for cutting veneers from a revolving log, and having a cross section corresponding in shape to the article to be produced, such, for instance, as the clamping members of spring pressed clothes pins.

LUBRICATING PULLEY.—H. G. VANCE, 4261 Moffett Avenue, St. Louis, Mo. The device forming the subject of this patent includes a bearing divided at the center and surrounded by a chamber for the lubricant. Between the opposed ends of the bearings the shaft carries a frame which mounts on radial arms toothed wheels adapted to rotate on their own axes, in addition to traveling with the rotation of the shaft. The centrifugal action normally tends to throw the oil away from the shaft, but the individual action of the toothed wheels throws the oil in the reverse direction against the shaft and bearing surfaces.

TORPEDO PLACING MACHINE.—J. D. BILL, Arcadia, Kan. This apparatus may be utilized to place on a railway track a torpedo or other signal device; it may be arranged to be loaded and operated to place the torpedo on the track in desired location during the running of the train; and it is an apparatus that may be constructed in a simple and economical manner.

### Prime Movers and Their Accessories.

INTERNAL COMBUSTION ENGINE.—S. PEARSON, Box 116, Kerrville, Texas. Means here provide for compounding the expansion effect to obtain the highest possible efficiency; for automatically operating the exhaust valve from the low pressure cylinder; for a plurality of high pressure cylinders united for delivery to a single low pressure cylinder and arranged to deliver the partially expanded gases on opposite sides of the low pressure piston; for manually and at will reserving the operation of the pistons and crank shaft; and for a plurality of high pressure two-cylinder engine cylinders operatively connected to exhaust into a low pressure cylinder and to opposide sides of the piston therein.

### Railways and Their Accessories.

SWITCH SHIELD.—R. F. CORDERO, care of J. A. Arroya, 82 Wall Street, New York, N. Y. In practice it is under numerous conditions impossible to close the switch. This invention eliminates the objections, by a device which will prevent the insertion of any foreign obstacle between the movable parts and which will be automatic in its action and will melt any snow or ice which might tend to obstruct the operation of the switch.

INDICATOR.—R. F. CORDERO, care of J. A. Arroya, 82 Wall Street, New York, N. Y. This device relates more particularly to an indicator for use upon cars, to be used as a device for automatically indicating the successive streets along the route which the car is approaching, and at the same time constituting an advertising device by means of which different advertisements are successively brought to view.

SAFETY DEVICE FOR MONORAILS.—R. F. CORDERO, care of J. A. ARROYA, 82 Wall Street, New York, N. Y. Mr. Cordero's invention maintains a car in equilibrium on a monorail when the gyroscope or other stabilizing device is inoperable through accident or other cause. An object is to so construct an auxiliary stabilizing device for monorail cars, which is regulated or actuated by the movement of the body of the car out of its normal horizontal position.

AUXILIARY PILOT FOR RAILROAD TRAINS.—I. WOLPER, 32 East Fourteenth Street, New York, N. Y. This device sounds an alarm in the cab of a locomotive when there is an obstruction on the track, and the inventor's object is to provide means adapted to close an electric circuit on the contact of an auxiliary pilot truck with an obstruction on the track, the circuit being adapted to energize a solenoid for opening a valve in the train pipe, and for ringing a bell in the locomotive cab.

### Pertaining to Recreation.

STEEPLECHASE PUZZLE.—H. VAN HOEVENBERG, care of Lake Placid Club, N. Y. An aim here is to provide an apertured plate representing a steeplechase course, with a horseshoe-shaped member representing a horse and rider, the latter being nominally separate from the plate, but adapted to be entered at a starting point and manipulated by a series of movements, embodying the running of a horse over stretches, varied at intervals by jumps from one aperture to another, which represent jumps in a steeplechase course, and returning to the starting point

CUE TIP HOLDER.—J. C. BECHTOLD, 794 Sixth Street, Detroit, Mich. This invention provides an improved holder which may be attached to the end of the cue in such a manner that there will be no danger of portions of the end breaking off, thereby loosening the holder or making it necessary to change the construction of the end when it is desired to place the holder again in position thereon.

GAME PIECE.—C. SCHULTZ, 500 East 153rd Street, Bronx, New York, N. Y. This invention pertains to pieces of the kind used more particularly in connection with bowling alleys, shuffling boards and the like, the more particular purpose being to provide a game piece properly weighted and having a projecting upper edge, the game piece being mounted upon a thick metallic bottom member in order to prevent it unduly wearing and also serving as an auxiliary weight.

JUMPING RING GAME.—J. STRANDERS, 265 Canal Street, New York, N. Y. This game comprises a number of rings intended to be laid one after another upon a base-board which is arranged to be struck by a suitable impact number with such force as to cause the rings to fly upward. Upon the base-board is mounted numbered pegs and pins and the rings descending will frequently fall so as to come to encircle of these pegs, and the number adjacent the peg so encircled will be added to the players score. Skill is added to chance to make the game interesting.

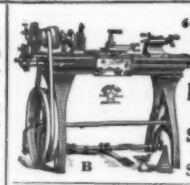
### Designs.

DESIGN FOR A PIANO PEDAL.—C. M. TREMAINE, 115 East 138th Street, New York, N. Y. In this ornamental design for a piano pedal the pedal is of a reversed L shape, of flat form, except at the one end, which has a slanting elevation of about one-third the length of the design.

DESIGN FOR CARPET OR RUG.—A. J. GREEN, care of G. S. Squire, Hartford Carpet Corp., 41 Union Square, New York, N. Y. This design represents a highly ornamental square cornered carpet or rug of oblong shape, with a border and a centerpiece.

DESIGN FOR CARPET OR RUG.—J. G. PEGEL, care of G. S. Squire, Hartford Carpet Corp., 41 Union Square, New York, N. Y. This design for a carpet or rug is oblong in form and of square corners. Flowers predominate in border and centerpiece, the latter having an edge of scroll work around the main central figure. Mr. Pegel has designed another carpet or rug of a length twice that of the width, which shows an ornamental field on which is pictured a moving horse with two children on his back. Another patented design for carpet or rug by the same inventor shows an elongated pattern twice as long as wide, with border and centerpiece of ornamentally delicate type with only slight contrasts. A fourth ornamental design by Mr. Pegel shows a form of the same relative dimensions as the carpet or rug just described. The border surrounds an ornamental field or ground on which a centerpiece is shown in a conspicuous body of white.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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**Great Northern Steamship Co.**


## The Late Joseph Lister

(Concluded from page 173)

years ago. Here is a merciful revolution which only he who has lived through the old surgery into the new can appreciate. Our amputations and compound fractures are now practically without danger. As to tumors: Sir Astley Cooper was most reluctant to remove so simple a thing as a wen from the august pate of George the Fourth, for fear a possibly fatal erysipelas might supervene. Today tumors in all parts of the body (even those involved in a most tortuous cervical labyrinth of vital vessels and nerves) are removed. Bone deformities following fracture are refractured, the deformed portions removed, or joined end to end, and all with little fever and no suppuration. Until within a few years past, fractures and other injuries of the skull have been invariably dangerous and the most fatal of all accidents. Now, unless the sufferer is instantly killed, there is much hope of his recovery. For example, Dr. Fluhner of this city operated upon a gun shot wound in which the ball entered at the forehead, traversed the entire cranium, was deflected by the occiput, pursued its further course downward into the brain; the back of the skull was trephined, the ball was found and removed. A drainage tube was passed through the entire brain from front to rear, and the patient recovered. Many tumors have been successfully removed from the brain, and more marvelous still, many brain abscesses have been healed through modern surgery. No region of the human body is now safe from the surgeon's knife. The thorax is frequently entered; and even wounds of the heart are now repeatedly sewed up, with recovery. The opening of the abdomen and the pelvis are now the commonest experience of the surgeon, who has much less fear of such proceeding than Sir Astley Cooper had of removing that wen from the royal scalp.

Such is the status of modern surgery. We now address the great Englishman formally as Joseph, Baron Lister—a good title; but generations hence many thousands of sufferers, on being triumphantly relieved, will have in grateful memory no other insignia than that of Joseph Lister, the Father of Antiseptic Surgery.

## Durability of Wood Cut in Spring and in Summer

TIMBER cut in spring and in summer is not so durable as that cut in winter, when the life processes of trees are less active. Scientific investigations sustain this statement. The durability depends not only upon the greater or less density, but also upon the presence of certain chemical constituents in the wood. Thus a large proportion of resinous matter increases the durability, while the presence of easily soluble carbohydrates diminishes it considerably. During the growing season the wood of trees contains sulphuric acid and potassium, both of which are solvents of carbohydrates, starch, resins and gums; they are known to soften also the ligneous tissue to a considerable degree. During the summer months the wood of living trees contains eight times as much sulphuric acid and five times as much potassium as it does during the winter months. The presence of these two chemical substances during the growing season constitutes the chief factor in dissolving the natural preservatives within the wood and in preparing the wood for the different kinds of wood-destroying fungi, such as *Polyporus* and *Agaricus*. The fungi can thus penetrate more quickly and easily into the interior of the wood when these wood gums are already partly dissolved and available for their own immediate use. From this standpoint it seems that the best time to cut down the tree is in the winter when sulphuric acid and potassium are present to a much smaller degree, and the fungi will not be assisted in dissolving the natural preservatives in the wood. The amount of wood gum is always less and more easily soluble in sapwood than in heartwood and for this reason the former is usually regarded worthless for industrial purposes.

**Grasshoppers as Fertilizer.**—A concern in Buenos Aires (Argentine) is about to install machinery to be used in a factory for producing fertilizing materials. It is proposed to utilize grasshoppers and their eggs, thus converting a destroyer of the crop into fertilizing material.

## NEW BOOKS, ETC.

DIRECT AND ALTERNATE CURRENT MANUAL. With Directions for Testing and a Discussion of the Theory of Electrical Apparatus. By Frederick Bedell, Ph.D., assisted by Clarence A. Pierce, Ph.D. New York: D. Van Nostrand Company, 1911. 8vo.; 360 pp.; with diagrams. Price, $2 net.

The manual comprises a series of studies and tests of direct and alternating current apparatus, devised especially for students, and directing attention to underlying principles and to the significance of results. This is a second edition of the work, which makes good certain omissions in the first and includes discussions of the induction motor, the induction generator, frequency changers, the synchronous motor, the synchronous converter, and wave analysis. The author, who is professor of applied electricity in Cornell University, has been at pains to arrange his material so that only the vital points are covered by the main division of the manual, the specialized tests and minor complexities being relegated to appendices.

THE WAY WITH THE NERVES. Letters to a Neurologist on Various Modern Nervous Ailments, Real and Fancied, with Replies Thereto, Telling of Their Nature and Treatment. By Joseph Collins, Physician to the Neurological Institute of New York. New York: G. P. Putnam's Sons, 1911. 8vo.; 318 pp. Price, $1.50 net.

Here is an excellently written book full of encouragement and counsel to all who suffer from a deranged nervous system. It takes the form of letters between patient and specialist, and in spite of the difficulty of the subject and the expert consideration of each case, not a dry line mars the work, which is instinct with humor, philosophy, and good sense. We may suspect that the letters from patients have been very much edited—they are entirely too good to be authentic in a narrow sense, for but few nervous sufferers have the ability to epitomize their lives so dispassionately and so well—but this in no wise detracts from their truth or from their claim to being documents of high pathological value. Sick headache, neurasthenia, psychasthenia, depression, hysteria, repressed emotion, the dual personality—all these forms and manifestations of functional disturbance are handled with a sure delicacy of touch that is in the last degree enlightening and helpful. Dr. Collins is a man in whom the learning of the schools is supplemented and vitalized by wide experience, and to these acquirements is added the gift of felicitous expression.

THE MODERN RAILROAD. By Edward Hungerford. Chicago: A. C. McClurg & Co., 1911. 12mo.; 476 pp. Price, $1.75.

To bring to the lay mind some slight idea of the intricacy and involved detail of railroad operation is the purpose of the present volume. Many of the author's articles have appeared in well-known magazines. He has performed an exceedingly difficult task in a very creditable manner. There is not a single phase of the subject which is not adequately treated. The building of a railroad is described in detail, with reference to tunnels, bridges, passenger stations, freight terminals and yards, locomotives and cars; then come chapters devoted to the railroad and its president, the legal and financial departments, the general manager, the superintendent, operation of the railroad, keeping the line open, the general passenger agent and his office, the luxury of modern railroad travel, getting the city out into the country, freight traffic, the drama of the freight, making traffic, the express service, the railroad mail, the mechanical departments of railroad routine, the coming of electricity, and lastly, an exceedingly interesting appendix, dealing with efficiency through organization. It is a very well made book, being nicely printed on light-weight paper, with detached illustrations.

LAMPS AND SHADES IN METAL AND ART GLASS. By John D. Adams. Chicago: Popular Mechanics Company, 1911. 12mo.; 114 pp. Illustrated. Price, 50 cents.

A very fascinating field of activity is opened up through the pages of this little handbook, and those who are interested in such work, either for the beautifying of their own homes, for presents to others, or as objects of sale, will find explicit directions for some artistic pieces. Built-up, soldered, etched, and sawn shades are all treated of, and eighteen complete designs are offered.

THE MANSIONS OF ENGLAND IN THE OLDEN TIME. By Joseph Nash. New York: The Bruno Hessling Company, 1911. Quarto; 104 plates. Price, $10.

The familiar title page of Nash's great book brings to mind the ponderous folio which has been an inspiration to many writers of fiction with a historical background. The original book was very expensive, and copies to-day bring a very high price. The reproductions, especially those in color, are very adequate and furnish a good substitute for the original book. There is an excellent reproduction of Levens, showing the curious examples of the topiary art. The interior views of the same palatial residence are very fine. The book is a highly attractive one, and should be in the possession of every architect as well as those who are fond of England in the days of old.

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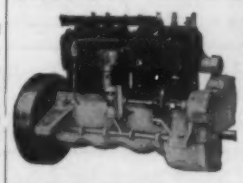

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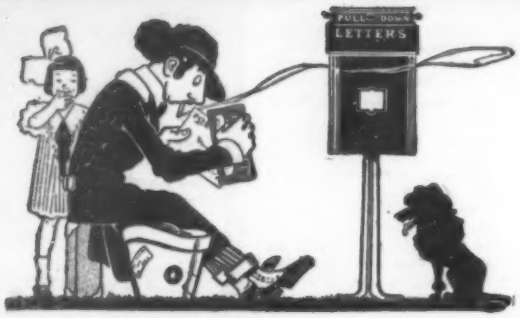


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# Welfare Work in Germany

¶ "It's all very well," said Professor Ernst Abbe, one day, "it's all very well to establish sick funds and pension systems for working men. But it's all very wrong if the sick or the old workingman is cared for by his employer as an act of charity. I will change all that."

¶ Now it happens that Professor Abbe was not merely a University Professor and a very able mathematician, but head of the great optical works at Jena. Because of his position he could carry out his theories in a practical way.

¶ Abbe sat down and thought and thought. At last he evolved a system. The system was this: He converted his entire fortune into a trust fund for the benefit of the employees of the optical works. He formulated a set of remarkable rules which entitled workingmen to certain payments out of the trust fund; and these rules he had enacted into laws by the state.

¶ What was the result? When a Jena workingman wants to get married, he tells his foreman that according to rule so-and-so he is entitled to so many days off, and proceeds to take that amount of time. He does not have to say "please." He takes the allotted time as a matter of right. If, after working a few years, he decides to get another job, he goes up to the cashier and asks him not simply for the wages due him, but also for the lump sum to which he is entitled according to rule so-and-so. Again he does not say "please." Even if he is discharged for incompetence, he has the right to demand his wages for the week, and also a lump sum; for Abbe felt that there is a moral duty on the part of every employer to take care of the workingman to prevent his becoming a burden on the community.

¶ Abbe's remarkable system, as well as the systems to which he objected because of their charitable aspect, will be discussed in the next number of the Scientific American by Waldemar Kaempffert, Managing Editor of the Scientific American. This will be the fourth of a series of articles in which German industrial conditions are discussed as a result of a visit to the great European works.

# The Outlook
## During the Campaign

PRESIDENT TAFT, in The Outlook, has fully reviewed his Administration and has given his judgment of many of the measures remaining on his "calendar of unfinished business."

The President will soon make public through The Outlook, in a complete way, his views on the Tariff, which will doubtless be a leading question in the coming campaign, discussing in popular terms the points on which issue is joined between the Administration and its opponents, with special reference to Schedule K.

THEODORE ROOSEVELT—CONTRIBUTING EDITOR

Woodrow Wilson, Judson Harmon, William J. Bryan, Oscar W. Underwood, Robert M. La Follette, and other political leaders of highest rank are speaking for themselves through The Outlook.

The actual history of the Presidential Campaign will be treated by The Outlook in an impressive and effective way.

Lyman Abbott, Editor-in-Chief of The Outlook, will consider the principles involved, in the spirit of broad statesmanship which has marked his work in many campaigns.

Theodore Roosevelt, from his position on The Outlook's editorial staff, will continue to discuss—exclusively through The Outlook—the policies and principles which he counts essential and vital in a government by the people, for the people.

Previous to the National Conventions, Francis E. Leupp, whose articles in The Outlook's series "What's the Matter with Business?" are attracting wide attention, will tell the story of two previous Conventions which have a direct bearing on the present situation.

Mr. Leupp was present at these Conventions and can now properly tell certain secret history and relate certain amusing and significant incidents never before printed.

The Republican and Democratic Conventions will be reported and described for The Outlook with appreciation of the merits of all parties, factions, and candidates, with a view to that which is essential rather than ephemeral, and with recognition of picturesque and dramatic incident.

After the nominations are made, The Outlook will have Mr. Leupp as its Special Campaign Commissioner, its eyes and ears to see and hear what the country is saying and doing, to interpret the campaign as it progresses. He will visit the Middle West, the Far West, the South, New England, the Central States, will talk with the farmer, the business man, the capitalist, the politician, and will report without bias what the people want in legislation and what they think of the candidates.

Two great issues, greater even than the Tariff, must be faced in this Campaign—Big Business, and Labor and Capital. The first was treated by Mr. Roosevelt in his Outlook editorial "The Trusts, the People, and the Square Deal." On this issue The Outlook will soon publish a series of articles entitled "The Cyclops of Trade," a vigorous statement of both sides of the question. The second issue was recently treated by Walter V. Woehlke, The Outlook's special correspondent, in his striking article "Terrorism in America." This will be followed by other articles dealing with new and grave features of the Industrial War.

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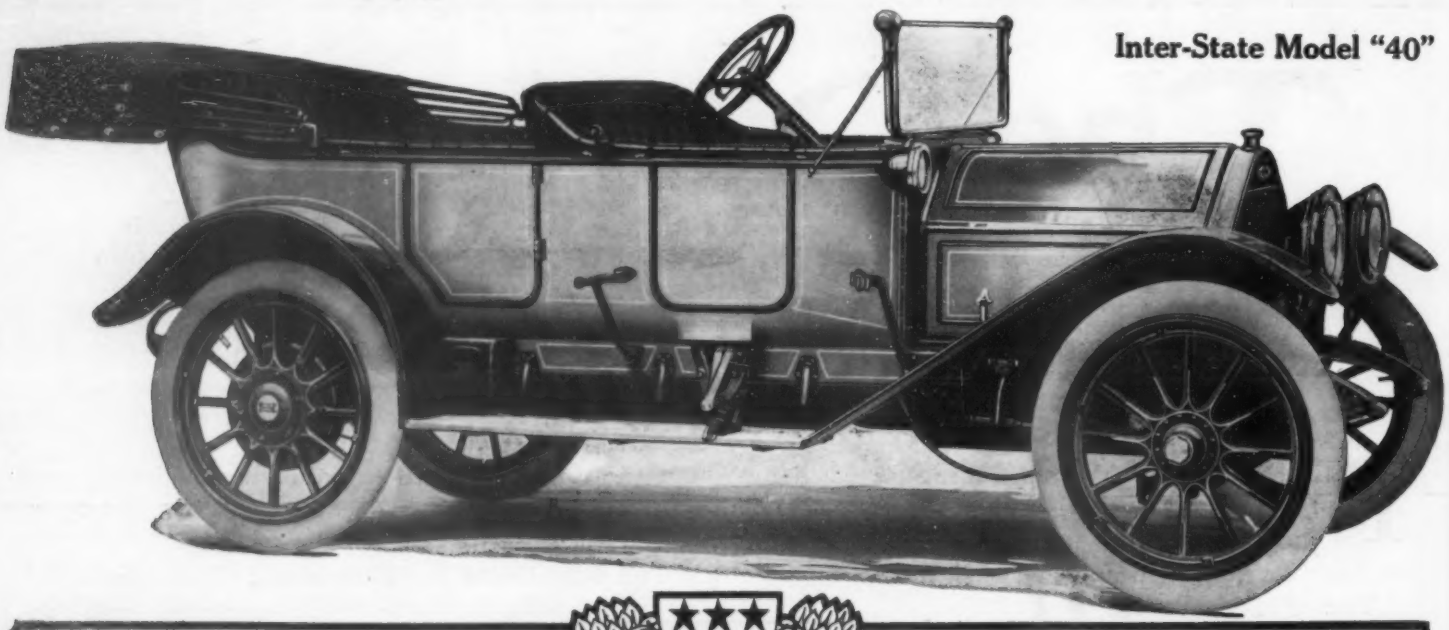

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